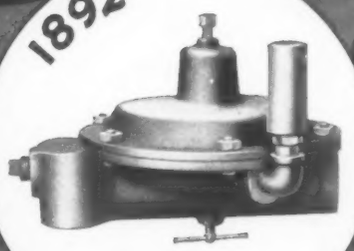
AMERICAN GAS JOURNAL

MAY 1941

Are Your Gas Controls MODERN • UP TO DATE ?

1892



1941

LIBRARY OF CONGRESS
JUN -7 1941
PERIODICAL DIVISION

REYNOLDS

Engineers will show you how Modernized, Coordinated Reynolds Gas Controls will save you money and increase efficiency.

For nearly Half a Century, Reynolds Engineers have designed and built better Gas Controls. As time and requirements changed, so have Reynolds Regulators. Even as the Original Little Giant was the finest regulator built at the turn of the century, so is its streamlined successor of today.

Reynolds new Coordinated Gas Controls solve every installation requirement. They insure greater capacity, greater safety—greater efficiency. Let a Reynolds Engineer solve your Gas Control Problems.

BRANCH OFFICES: 423 Dwight Building, Kansas City, Mo.
2nd Unit, Santa Fe Building, Dallas, Texas

REPRESENTATIVES: Eastern Appliance Company, Boston, Mass.
Wm. A. Ehlers, No. 268 Park St., Upper Montclair, N. J.

REYNOLDS GAS REGULATOR COMPANY, Anderson, Ind., U. S. A.

Recognized Gas Control Since 1892

THE Natural Gas Industry, with an increased volume of approximately 10% for 1940 over 1939, faces a substantially higher percentage of increase during 1941. · Accelerated residential construction, commercial applications and the industrial beehive induced by the National Defense Program all point to one of the greatest periods of productivity and expansion the Natural Gas Industry has ever known.

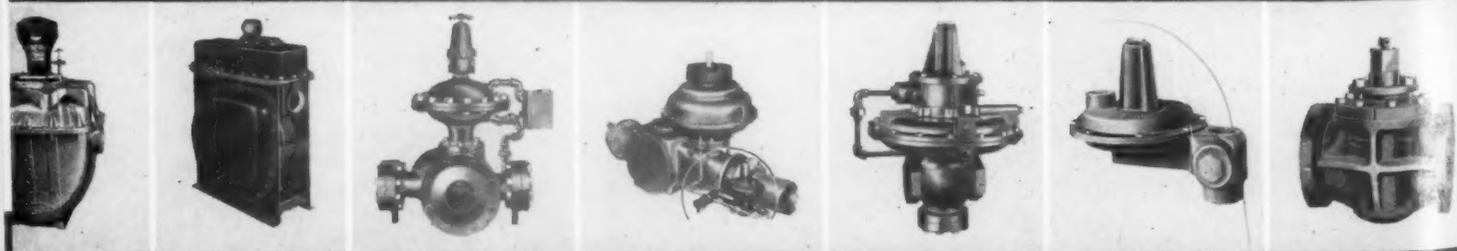
Much of this increased load can be directly attributed to the workings of science. The necessities of industry are furthering the interests of Natural Gas by developing new applications and uses.

The alert equipment manufacturer must keep step with the demands of the Industry. Here at the Pittsburgh Equitable Meter Company our engineering staff and research laboratories are constantly at work developing, designing, improving the products that bear the EMCO trade name. Additional benefits from the realm of purely scientific endeavor are provided by our meter fellowship at a world renowned scientific institute.

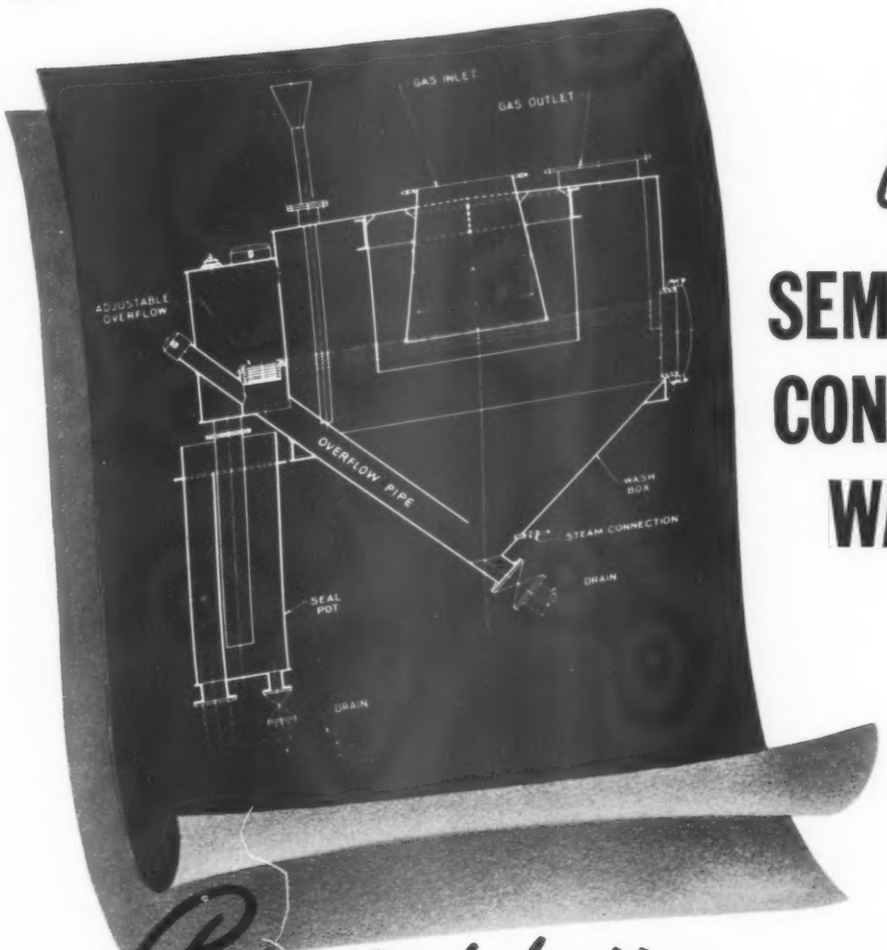
In the Natural Gas Industry, tomorrow's problems involving longer lines, higher pressures and heavier loads are now being studied. In EMCO laboratories and on EMCO drawing boards are now being evolved the measurement and control equipment which will be needed to serve the expanding demands of this great industry.

PITTSBURGH EQUITABLE METER COMPANY
MERCO NORDSTROM VALVE CO.
NEW YORK · BUFFALO · PHILADELPHIA · KANSAS CITY · TULSA · LOS ANGELES · *Main Offices* · PITTSBURGH, PA · DES MOINES · CHICAGO · COLUMBIA · MEMPHIS · OAKLAND · HOUSTON

EMCO METERS and REGULATORS



WASH BOX CLEANING TROUBLES ENDED



By the

SEMET-SOLVAY CONE BOTTOM WASH BOX

Patented bottom overflow removes heavy oil tar Continuously

Having wash box troubles? If you use heavy oil as carbureting fuel, and have an old-fashioned side overflow wash box, you know what we mean—frequent shutdowns to remove a heavy tar deposit that has been cooked into a pitchy mass; production interrupted, sometimes just when you want it most; lower capacity and higher labor cost.

Why not eliminate all these troubles with a Semet-Solvay Cone Bottom Wash Box? Other operators using heavy oil with this improved wash box will testify that under normal operating conditions it is entirely self-cleaning.

Eliminate wash box shutdowns. Get rid of a messy, disagreeable job. Write us describing your present equipment and we will gladly send you full information concerning a change-over to the Semet-Solvay Cone Bottom Wash Box.

SEMET-SOLVAY

ENGINEERING CORPORATION

40 Rector Street — **New York, N. Y.**

AMERICAN GAS JOURNAL, May, 1941. Vol. 154, No. 5. Published monthly by American Gas Journal, Inc., at 34 North Crystal St., East Stroudsburg, Pa. Executive and Editorial offices at 53 Park Place, New York, N. Y. Entered as second-class matter, October 7, 1928, at the post-office at East Stroudsburg, Pa., under the Act of March 3, 1879. Printed in U. S. A.

FIRST GAS

World's First Plant Which Liquefies Natural Gas for Storage. East Ohio Gas Co., Cleveland

USE CLARK "ANGLES"

The world's first commercial gas liquefaction plant—in which natural gas is changed to a liquid and stored in one six-hundredth of the space it originally required — is using CLARK "Angle" Compressors for the vital refrigeration processes which represent the "heart" of the plant's operation. By means of these refrigeration processes, the gas is stored in liquid form at a temperature of 248 degrees below zero, Fahrenheit.

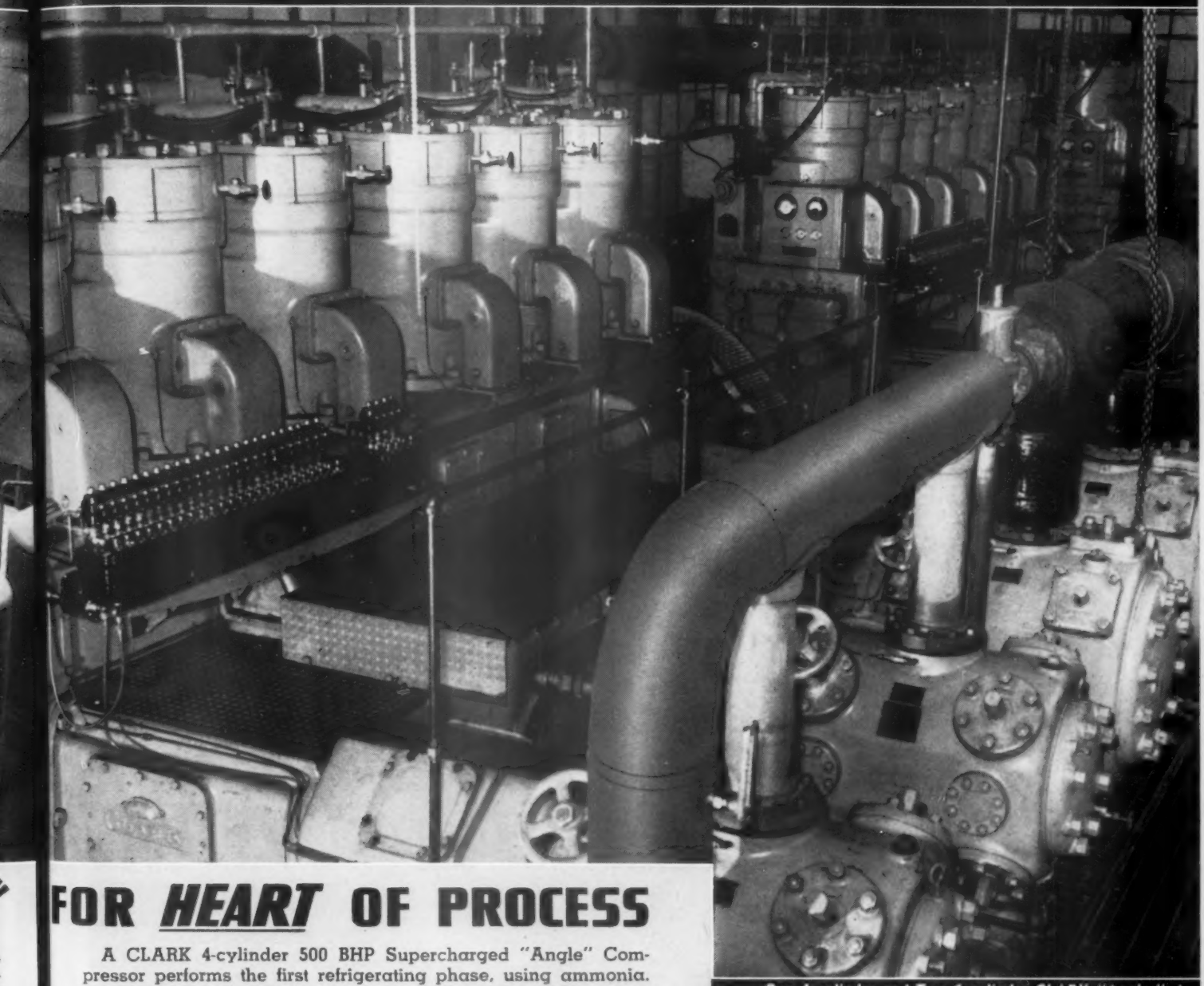
This unique plant has been installed at Cleveland by the East Ohio Gas Company. It has a liquefaction rate of 4,000,000 cu. ft. of natural gas per 24 hours, and a regasification rate of 3,000,000 cu. ft., of gas per hour.

CLARK 6-cylinder, 600 BHP "Angle" Compressor

CLARK BROS. CO., INC.—OLEAN, N.Y., U.S.A. Export Offices: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Texas; Chicago, Ill.; Boston, Mass. (131 Clarendon St.) West Coast Offices: Smith-Booth-Usher Co., Los Angeles, Cal. Foreign Offices: 72 Turnmill St., E. C. 1, London; 4 Str. General Poetas, Bucharest, Roumania.

CL

LIQUEFACTION PLANT

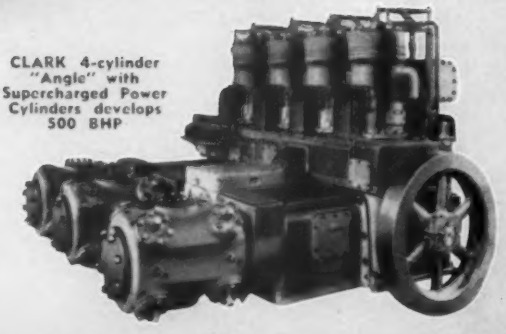


One 4-cylinder and Two 6-cylinder CLARK "Angles", in Refrigeration Service, East Ohio Gas Co., Liquefaction Plant

FOR *HEART* OF PROCESS

A CLARK 4-cylinder 500 BHP Supercharged "Angle" Compressor performs the first refrigerating phase, using ammonia. Two CLARK 600 BHP "Angles", totalling 1,200 BHP, then perform the second refrigerating phase, using ethylene. All three of these CLARK units are fitted for 2-stage compression and are specially equipped, and all have automatic recording instrument type speed control.

For this application CLARK "Angles" furnish the accurate control of gas pressure and temperatures necessary. Our engineers will welcome an opportunity to consult with you.



CLARK 4-cylinder "Angle" with Supercharged Power Cylinders develops 500 BHP

CLARK

Affiliated Companies

Dresser Manufacturing Company, Bradford, Pa.
Bryant Heater Company, Cleveland, Ohio
Pacific Pump Works, Huntington Park, Calif.
Van der Horst Corporation of America.
Porous Chrome Hardening for engine parts.

LOOK FOR ALL FOUR

before you decide

SIMPLICITY—unskilled labor assembles standard parts on plain-end pipe, using only a wrench.

SPEED—typical examples: 5 minutes for 8"; 8 minutes for 14"; 12 minutes for 20" (two workmen).

FLEXIBILITY—expansion and other pipe movements absorbed; curves with straight pipe.

TIGHTNESS—The *only* flexible joint with a 50-year, *proved* record of permanent tightness.

The winning foursome of Dresser advantages will do for you what they did for the builder of this 5½" OD, 105-mile pipe-line in Texas . . . expedite the job, lower the cost, "up" the satisfaction. • Nothing succeeds like Dressers' Simplicity, Speed, Flexibility, Tightness. *Only Dressers Give You* "ALL FOUR"!

DRESSER

PIPE COUPLINGS

FITTINGS?—We make a complete line of Long, Cast, Reducing, and Insulating Couplings, also steel and malleable ells, tees, crosses, etc. Write for our General Catalog Number 36.

DRESSER MFG. CO., BRADFORD, PA. Offices at New York, Chicago, Houston, and San Francisco. *In Canada:* Dresser Mfg. Co., Ltd., 60 Front St., W., Toronto, Ont.

VOLUME 154
NUMBER 5

AMERICAN GAS JOURNAL

WHOLE
NUMBER 3809

ESTABLISHED 1859

MAY, 1941

PUBLISHED MONTHLY BY
AMERICAN GAS JOURNAL, Inc.
53 Park Place, New York

S. G. KRAKE, *President and Treasurer*
M. E. KELLEHER, *Secretary*
A. I. PHILLIPS, *Editorial Director*
H. T. MATTHEW, *Business Manager*
JAMES C. MUNN, *Midwest Representative*
10515 Wilbur Ave., Cleveland, Ohio
Tel. Garfield 1055
THOMAS MORGAN, *Western Representative*
168 N. Michigan Ave.
Chicago, Ill.

Copyright 1941, American Gas Journal, Inc.

Subscription $2.00 per year U.S.A.; $3.00 Canada; $4.00 Foreign. Single copies, 25cts.

CONTENTS

Distribution's Part in National Defense—T. J. Strickler 9

The Technical Section and National Defense—A. Gordon King 11

Useful Products from Natural Gas—Frank H. Dotterweich ... 14

The Orifice Meter, A Product of Cooperation Within an Industry—Allen D. MacLean 19

Industrial Development of Natural Gas in Texas—N. Van Deren 27

How to Isolate Vibrating Machinery—W. F. Schaphorst 28

Stopping Customer Traffic Through Appetizing Meat Odors—Arthur J. Larson 31

Air Humidity—Part 3—O. J. Kuenhold 33

Insurance for Gas Companies—Clarence T. Hubbard 37

Validity of City and State Gas Regulations—Leo T. Parker ... 43

Economical Trencher Operation for Widespread Gas Divisions—J. E. C. Currens. 47

The Emergency Repair of Cast Iron Mains—W. Boden 53

Book Review—Public Utility Economics 55

Six Mile All-Welded Gas Line Installed in New Jersey—Thomas L. Mellick 58

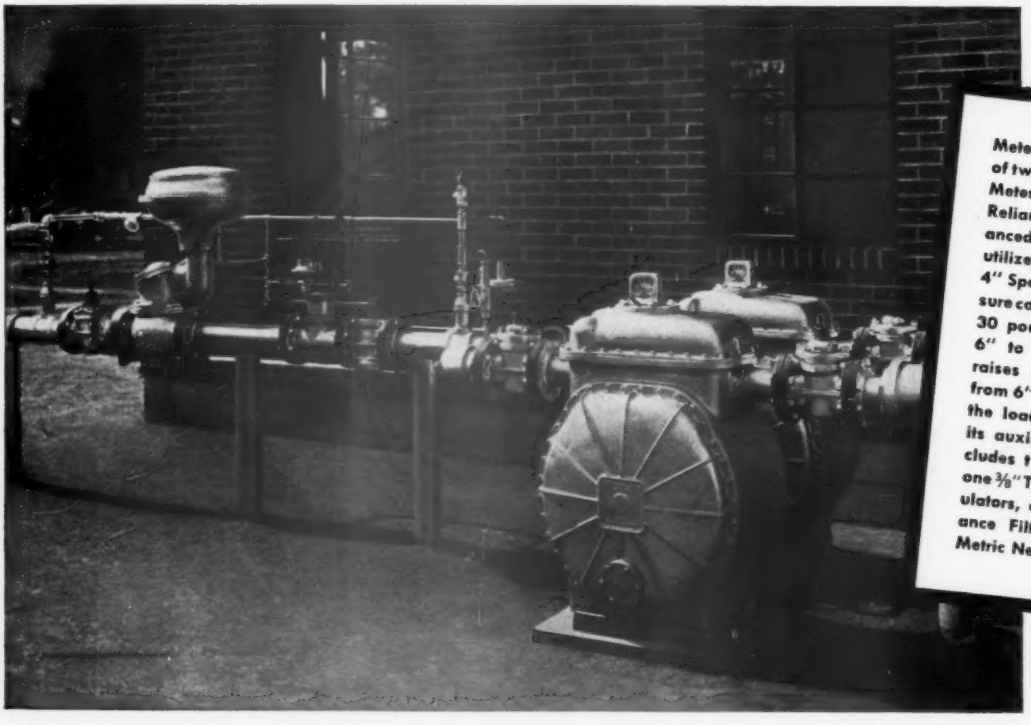
News of the Gas Industry 61

ANOTHER ALL-AMERICAN JOB

This model new master meter station was built by a leading gas company in the South, to measure gas to a large construction operation.

The meters and regulators specified for the installation were American Meter Company products, bearing the METRIC-AMERICAN or RELIANCE-AMERICAN trademark.

This gas company is exacting in its specifications on all counts relating to instrument accuracy, low maintenance, and long-term values. It is impressed only by actual performance and cost records.



Metering equipment consists of two 500-B Metric Ironcase Meters. A 4" Type CBV-300 Reliance Combination Balanced Valve Regulator is utilized in conjunction with a 4" Spencer automatic pressure controller; inlet pressure 30 pounds, outlet pressure 6" to 8". This controller raises the outlet pressure from 6" to 8", depending on the load requirements, and its auxiliary equipment includes two 1" Type H and one ⅜" Type A Reliance Regulators, a ¾" Type A Reliance Filter, and three ¼" Metric Needle Valves.

METRIC METAL WORKS • ERIE, PA.

AMERICAN

METER COMPANY

INCORPORATED (ESTABLISHED 1836)

1487

JUN -6 1941

MAY
1941

AMERICAN
GAS JOURNAL

VOLUME 154
No. 5

Distribution's Part In National Defense

By
T. J. Strickler
President, American Gas Association
Vice-Pres. & General Manager,
Kansas City Gas Company

I COME before you today not to discuss technical subjects, as many of your speakers will do, but to discuss one of the most vital subjects ever to face our industry; that is, the part the gas industry will take in the defense of our country, and the defense of all other peace-loving democracies. As President of the American Gas Association, it has been my duty, and pleasure, to travel thousands of miles in many sections of these United States, addressing many meetings and talking with hundreds of the business leaders of our nation. The universal opinion is that American business faces a challenge such as it never has before.

The fact that these are grave times we are facing will be admitted by all of us. Anyone who would attempt to predict what will transpire tomorrow in the arena of world affairs would be a foolish prophet indeed. The picture is too big and complicated to permit of even the simplest clarification. Our citizens, nation, and American business are faced with brand new problems. In reality we have no past pattern on which to gauge our future guidance. Our nation and businesses have passed through other wars and national catastrophies, but never one like this. That is why I have said before, and reiterate now, that we are not facing a crisis, but a challenge.

One of the most timely and important problems facing us today is the important part the gas industry will play in national defense in terms of armies, navies, guns, tanks, ammunition, and airships. They naturally are the mobile ramparts upon which we rely to repel attacks from without, and to safeguard our physical security. The appalling destruction now being wrought in many parts of the world by contending armies and fleets has brought home only too vividly the realization that war is fought with machines—machines which have changed completely methods of attack and, accordingly, methods of defense.

In past wars we relied for our safety upon the valor of our fighting men. The nations having the greatest number of trained men won the wars because the equipment of war, other than ammunition, was secondary. Naturally, when the defense of our country depended primarily upon trained man power, the gas industry played a minor part in the preparation of national defense.

Today the picture has changed completely because war is fought with machines and gas is used to make those machines. Individual bravery is no match for planes and tanks and automatic machine guns. With machines at his command one man may sink a battleship or blow up an ammunition depot. Mechanized defense is the only protection against mechanized attack. To build up this mechanized defense then, we must have first the necessary plants to make the machines and the tools with which to make them. These are not tools in the ordinary sense, but precision machines, some of them weighing many tons which operate with incredible speed and accuracy in shaping the parts which go to make the tanks and engines and other weapons of modern warfare. It is apparent, therefore, that gas as a fuel to operate these machine tools

T. J. Strickler
Sudvarg Studio

is one of the first essentials of national defense. It is the driving force put to work turning out mechanical equipment needed to maintain our army and navy. We, of the gas industry, must not only plan our operations to meet the requirements of industrial plants which produce war machines, but also fulfill our obligation to our peace time industries and domestic customers.

Squarely upon the shoulders assembled here rests the tremendous responsibility of keeping gas service ready and available to all. Knowing the past history of our industry, and being familiar with the past performances of this group, I have no hesitancy in pledging to the American people that, come what may, the gas industry is ready, and willing, to carry its full share of its responsibility until the job is done. I have no fear of our inability to do anything that we set our shoulders to do.

I do not share with those who are of the opinion that our security is

in immediate danger of attack from without. I believe that the greatest danger lies from an attack from within. We, in American industry, should profit by what we have seen happen to others during the past year. To be effective, national defense must be complete defense. It must hold at bay not only enemies outside the walls, but also the enemies who assail it from within. We must be vigilant to resist one form of attack as well as the other.

In some respects the danger from within is the greater of the two. Those who wage it wear no uniforms. They hide their evil designs behind innocent occupations. They parade their destructive purposes in the clothing of democracy. They try to impair our physical strength by sowing seeds of moral discord. They invoke the protection of the very government they attempt to overthrow.

During your meeting here I am sure there will be considerable discussion of plans and methods that are under consideration should an attack come from without. As I have said before, I do not join with those who expect an attack from without in the very near future, but it would be folly for us to cover our eyes to what is happening elsewhere throughout the world, and merely say, "It Can't Happen Here." Let us be far-sighted and not be caught napping. We should make every preparation possible for the protection of our plants and properties should an outside attack occur. Already a number of companies are working on plans that can be put into immediate effect should such an emergency arise. To some of you this may seem like a case of "Wolf, Wolf," but if you will stop and analyze what has taken place throughout the world you will realize that the time we spend now in such preparations may prove to be our most valuable asset at a later date.

We who are familiar with distribution problems in the United States have felt at times that our lot was indeed a difficult one. Supplies of gas sometimes diminish, floods occasionally raise havoc with our distribution systems. Major or minor mishaps are apt to strike almost any time. Yes, we have had some difficult problems to deal with during the past decade, but stop and think for one moment what the distribution executives in England have had to deal with during the past eight months. Theirs has been a second Dunkirk. How these men have carried on under such devastating destruction and continue to deliver gas service is a miracle that should, and probably will be, recorded in history. They were not prepared to deliver service under such destruction. They have had to work out solutions as they went along. They certainly have our heartfelt admiration for the courage and initiative they have displayed during these trying months.

How I wish that there were some tangible way that we, of the same profession, could help them in their grave hours of need. I do hope that they will take additional courage in realizing that the American gas industry was one of the first to offer its facilities for national defense and for use in the manufacture of war supplies for Britain, and for all other peace-loving democracies. We will do everything within our power to help supply them with the material that will mean their ultimate victory. The dictators know well on which side of the fence the American Gas Industry stands. We will stay with our associates in the democracies until the very end.

But mere words are not enough. Let us back them up with deeds. We should never allow ourselves to assume the attitude that what is happening to them can never happen to us. We should profit by their experience and courage and do everything within our power to help them, and to help ourselves be adequately prepared in case the same thing should happen to us. If we start planning now I have no fear that the American gas industry will not be able to take care of itself if we are called upon to do so. This preparation and the carrying out of plans is the responsibility of you, gentlemen. I know many of you personally, and further know your qualifications, and I assure you that I have no fear of the ultimate outcome so far as the gas industry is concerned should war come to our shores.

The American gas industry is well ahead in its defense plans and preparations. A number of gas companies have been obliged to construct new mains and transmission lines to meet the requirements of industries who are manufacturing vital war materials. All of this work is progressing with dispatch to accommodate large scale government contracts. In no case have contracts been delayed by the inability of the gas industry to do their share. This close cooperation will continue to the utmost of our ability.

During these abnormal times it is necessary for us to not only concentrate our efforts on the supply of fuel for war industries, but also we must be ever mindful of our obligation to our peace time customers. We must continue to be on the alert for ways and means to improve our service to those whom we have had the privilege of serving throughout the years. According to the past history of the gas industry, some of its most important progressive strides have been made during times of stress. Apparently we work much better under pressure, just the same as our product. I am sure that our industry will emerge from this emergency sturdier and more soundly established than ever before.

It is becoming more difficult each day to secure many of the materials and equipment that we need in the operation of our business. We have heard much of priority and we will continue to hear more about it in the months ahead. It is my advice to place orders for vital materials as far ahead as humanly possible. In doing this we not only help ourselves, but help others as well. Everyone connected with the distribution or motor vehicle operations should study his requirements and place his orders as far in advance as possible because regardless of long time contracts, there is bound to be disappointments when materials do not arrive. Ours is a vital industry, but others will receive priority over us unless we foresee our requirements well in advance. This, too, is an obligation which falls upon the shoulders of those assembled here, more so than on any other division of the gas industry.

In view of the difficulties which are bound to arise in the securing of materials, it is up to this group to use their initiative as never before in working out substitute materials and equipment. Aluminum, copper, tin, steel, and many other vital materials will become increasingly hard to secure. We can't wait until they can be secured, so it will be up to you gentlemen to work out substitutes to carry us through this emergency. Some may be costlier, some may be cheaper, but the gas service must continue to flow. Already the program committee for the Spring Conference is considering discussions on what to do when the supply of coal and oil grows scarce, regarded as a certainty. Further thought will be given on how to meet mounting costs of labor, pipe, and all other materials. These are facts which we must face, and have the answers ready when the time arrives.

Through the initiative of you men assembled here will come many start-

ling discoveries during the coming months. I predict that not one gas company will close down because of inability to secure some needed material. You will find a way to do the job in another manner, and in many cases it will be superior to the way it is being done at the present time. In these abnormal times, permanent progress will be made and further contributions given to the efficiency of operating systems.

Another problem which is always with us and serves as a serious handicap to our industry as well as to all other industries, is the ever increasing tax burden. According to the American way of life the usual course is this: As productive skill develops costs are lowered, as costs are lowered, prices are lowered, as prices are lowered, consumption expands. By this process we have built up the highest standard of living the world has ever known.

Unhappily we have been veering from this course. Government, especially in recent years, has stepped more and more into the picture. The savings in time through efficiency, money and effort, effected by technical skill, are siphoned off in taxes due to the increasing cost of government.

The gas industry's most striking achievement in the past few decades has been its ability to carry the constantly mounting tax load and at the same time pass on to its consumers substantial benefits made possible by the technical skill of our industry.

In contrast, the trend in the cost of government has been steadily upward year after year. In some instances, government has taken more of the earnings of corporations than either the workers or the stockholders. Nonetheless, industry by improving its methods of operation has not only shouldered this heavier tax burden, but has given the consumer many benefits that were not enjoyed a few years ago. The gas industry cannot continue forever to pay higher taxes each year without sometime an increase in the price to our consumers. In extraordinary times like we are having at the present, I believe that every citizen has a right to insist that the government cut to the bone all non-defense expenditures. We of our industry have never objected to paying our full share of taxes, but we realize that taxes cannot be increased indefinitely.

As our nation rapidly moves from an economy of peace to an economy of war, it is becoming increasingly clear that our path in the future will not be a bed of roses. As a matter of fact, it has never been, and we never want it to be, because it is easy to grow soft under such circumstances. The gas house gang did not gain its reputation the easy way, but rather by winning good clean fights. We are ready and willing to assume our full share of the one that lies ahead. We have no past pattern that we can use because conditions today are totally different from anything we have ever faced. It is up to you gentlemen to cast new patterns for us as we go along, and with the combined initiative of this group, we have no fear whether or not the patterns will fit and work.

But the war will not last forever, and when it is over, we in America, as well as others, will face the colossal task of reconstruction, which will test our resourcefulness no less than national defense. Barriers must be leveled, the debris of battle must be cleared away, trade must be revived. Yes, I assure you that the path ahead will be rough, but this grand old industry of which we are all a part has weathered many storms, and I have no fear of our ability to take in our stride the ones which lie ahead.

Address at Joint Meeting of the Distribution Conference and the Conference on the Operation of Public Utility Motor Vehicles, Pittsburgh, April 21, 1941.

The Technical Section And National Defense

By

A. Gordon King, Secretary

American Gas Association Committee on National Defense

AS MEMBERS of the American Gas Association you are all aware of the fact that the Association has had national defense in mind ever since hostilities first broke out in Europe. Two important things appear in the record, the first being that the Executive Board through Past President Beckjord and President Strickler have offered the facilities of the Association and the industry to the Secretaries of War, Navy, Department of the Interior and the Advisory Commission of the Council of National Defense.

The other was the creation by the Executive Board of a general committee on National Defense, of which Mr. George F. Mitchell was appointed Chairman.

It being obviously desirable that the Association, in addition to its permanent representatives in Washington, should have adequate liaison for matters arising there, Mr. Marcy L. Sperry, a member of our National Defense Committee, was appointed for that purpose.

There is a more recent but equally important appointment made upon the recommendation of the Executive Board by the Secretary of War and that is the selection of Mr. W. Cullen Morris as the American Gas Association's representative on the National Technological Civil Protection Committee.

There is also a vitally important specialist organization, the National Fire Protecton Association on which the American Gas Association is represented by Mr. N. F. Bertl. Mr. Morris and Mr. Bertl are also mem-

Presented at American Gas Association, Technical Section, Eighteenth Annual Distribution Conference, Pittsburgh, Pa., April 21, 1941.

bers of the Association's Committee on National Defense.

Our contacts with the Institution of Gas Engineers (England) are excellent and there is a constant exchange of valuable information.

Through these and other like channels, the Association is endeavoring to make and maintain appropriate contacts with all of those who either know or are in a position to find out the things we must know in order to provide the adequacy and continuity of service of which the gas industry has been so proud throughout its long career.

It is not necessary to further advocate or labor the point as to the important part the gas industry plays in normal times in the home, in commerce and in industry. In times of national emergency it is one of the great and essential tools for the production of war material; its ramifications in the great cities, the smaller communities, the munitions plants, the army camps and cantonments, are amazing. Curtailment or severance of service is totally unthinkable. Now as all of us know the only information as to what is happening to the production plants, transmission and distribution systems and all of the accessory equipment under war conditions is the reports from visitors to Europe, articles and items in the trade press of the industry and if intelligently studied, both newspaper and magazine articles as well as photographs and particularly the newsreels.

We have collected and studied much of this information. A committee of the Technical Section is busy analyzing the many articles and special publications issued in Europe and the United States.

The attacks on the producing plants, and they are practically all manufactured gas properties, seem, according to the information we have received, to divide themselves up into two classes. These are the attacks from within, and the attacks from without; by this segregation I have in mind in the first class the attempts made by the saboteur, the Fifth Columnist or whatever name you elect to designate this unhealthy, un-American verminous appendix. In the second division I have in mind the attack chiefly from the air and under certain geographical conditions from artillery or from aboard ship.

Now the saboteur and the Fifth Columnist insofar as the organization and the property of the gas industry are concerned can I believe be well handled by Americans. They do not have to learn from those who are fighting against a hated form of government on their own soil how to handle such individuals, although they well may learn some of the methods employed to destroy both properties and personnel. We have our local peace officers, in many cases State Police, the Federal Bureau of Investigation of the Department of Justice, and our own good horse sense, plus a wide awake loyalty of our associates.

In considering the information that should be available and the best means of securing it, the Executive Board authorized, at the request of the Association's Committee on National Defense, the Technical Section to proceed with collecting information looking toward a summary of different methods of plant protection that have been adopted in this country, and perhaps Canada.

Under the direction of Chairman Hartson, a committee which was considered to be especially well qualified, sat down and prepared questions to be sent to all of the gas companies in this country and Canada. The personnel of the Committee included production, distribution and chemical engineers, statisticians, motor vehicle operators and a natural gas engineer representing Harry D. Hancock, Chairman of the Association's Natural Gas Section.

The questionnaire is being handled entirely by the Association's Statistical Department and all replies as they are received are kept within that group and no one else is advised of the identity or origin of the answers. All questions were arranged to be answered by an affirmative "yes" or a negative "no."

I am advised by the Association's Statistical Department that the response is excellent and that replies are coming in from all over the country. Further, that some of them are exceedingly interesting. As of April 14th, 50.2% of the Manufactured Gas Meters and 26.1% of the Natural Gas Meters have reported.

To date there have been exceedingly few who have refused to comply and there have been some who felt such an unswerving and unwavering belief in the loyalty of their employees as to clearly indicate, "it could not happen here."

Perhaps the most striking thing which has so far appeared from this activity is the fact that the questionnaire appears to be serving two purposes. The first is as was intended, i.e. the Association should secure accurate information as to the protective methods adopted so that the information in the aggregate may be used for the benefit of the industry as a whole. Consideration must be given to the fact that the various government departments, including the Army and Navy as well as the Department of Justice, will, some have already done so, require such information from the Association.

For example, the Association being asked by the United States Government, through both the Treasury Department and the Ordnance Department of the Army, to furnish information on toluol, assigned Mr. Alfred I. Phillips, a consulting engineer, to survey the toluol facilities of the gas industry.. Mr. Phillips donated his services in the cause of national defense and his report after being accepted by the Association was delivered personally by him to a designated officer of the Army Ordnance Department.

The second was the thought that a listing of questions might be so thought-provoking as to be educational and informative. This has proved to be the case.

Now I shall not attempt to try and say to you against whom or what we are discussing defensive measures nor would I attempt at this time to guess, should such attacks occur, from where they might originate.

Rather does it seem to me our duty is clear. We have had committed to our charge properties of various types and systems of different kinds all engaged to some degree in furnishing a vital fuel service to this nation. In some parts it is domestic only; in others it may be domestic and industrial and in others it may be employed in the most vital of war measures.

A characteristic of the gas industry in this country is the individual operation of the individual plant generally under the direction of an individual and his staff, located in the area where the gas is furnished to a community. Therefore, no two situations could ever be alike and no specific rules or regulations can be promulgated.

From the day the gas industry first turned gas into the mains to proceed through the services and meters to the now, to us, old fashioned lighting fixtures, continuity of service has been one of the unwritten rules.

Therefore it seems to me that our duty lies before us sharply defined and simply stated. It is, no matter what the conditions, either from within or without, that we must ever maintain the service.

Down through all the years when gas made its periodic fights against the competition of other sources of light and heat, the industry waged a winning fight and emerged stronger than ever before.

The first President of the American Gas Association, the late George B. Cortelyou, said at Princeton University in the Cyrus Fogg Brackett Lectureship in Applied Engineering and Technology, January 10, 1933, "Today, gas and electricity, when properly coordinated and correlated, supplement and reinforce each other in supplying energy in the form of heat and light, the twin props of our modern civilization. Where they come into competition, it should be possible by the application of economic and engineering principles, to determine the natural line of cleavage between them so that each may do the work for which it is best fitted. Thus the maximum beneficial use of each will be served."

As engineers we obviously will not be remiss in looking into all of those things which could serve to destroy or impair that continuity of service, again either from within or without. As I hope I have indicated it is my firm belief that we can, with skilled assistance and knowledge we could not under normal circumstances be expected to possess handle ourselves and our properties with respect to attacks from within.

With respect to the attack from without, I believe we should study all we can as to what is happening on the other side and endeavor to view through those spectacles our own plant and distribution system situations. It would seem axiomatic to me that after studying the things that should be done then the things which must be done stick out like sore thumbs. Many of them we shall automatically take in our stride. Distribution men from those sections of this great country who have had to meet the damage and destruction by natural causes have handled themselves and their properties amazingly well and are equipped for many of the emergencies which might come to us.

On the Saturday of the Easter week-end I read a piece in a New York newspaper cabled from London by Craig Thompson, who said "In parts of the world where men have peace and perhaps a little time to pray it was Good Friday today. It wasn't in Coventry and it wasn't in Birmingham. In Coventry men with faces drawn and eyes expressionless shovelled their homes into dump trucks a spadeful at a time.

"... Coventry ... has been wrecked as it never was four months ago when the Germans made a spectacular raid. ...

"Then Coventry buried its dead in trenches. They are burying them where they find them now in stark simplicity and they are still turning over the rubble piles in the search for men and women who were alive yesterday."

The Coventrys and the Birminghams of England; the Belgian, Czechoslovakian, Dutch, French, Norwegian, and Polish cities of the Europe that was are the homeland of many an American's immediate forbears. The roots are deep and the ties are sympathetic so that perhaps the realization of what is actually happening to the places and the people we know is the more apalling. Some of us were born over there, and perhaps, after all, it could happen here!

In conclusion I say to you in all earnestness that because I know you all so well and what you stand for; because I know something of the splendid history of the gas industry; and because I know that it is second nature for the gas engineer to believe in and practice the continuity of service, therefore I know in my own heart what we shall do in the emergency, should it come. We shall prepare ourselves and our properties. We shall find out what the other fellow has done under conditions which it is hard to believe human beings and physical equipment could withstand—and we shall adapt the best of them to our present situation. There may be no uniforms and there may be no flags and there certainly will be no bands but—there will and must be a deep and abiding sense of satisfaction in having done the job assigned to us—than which no greater praise can be had.

Joint Luncheon Conference on National Defense held at Pittsburgh, Pa., April 21, 1941, in connection with Distribution Conference and Conference on the Operation of Public Utility Motor Vehicles.

Useful Products from Natural Gas[1]

By
Frank H. Dotterweich

Assoc. Prof. Natural Gas Engineering
Texas College of Arts and Industries,
Kingsville, Texas

NATURAL GAS as produced is a mixture of hydrocarbon and non-hydrocarbon gases. The hydrocarbon gases may include methane to heptane and the non-hydrocarbon gases, carbon dioxide, helium, nitrogen and hydrogen sulfide. These gases can be separated, by modern methods of extraction and fractional distillation, into the following groups: dry gas, liquefied gas, and natural gasoline.

Natural gasoline may contain the hydrocarbons of isobutane through to the heptanes. The use of this product as a source of fuel is well known. Dry gas consisting of methane to propane and liquefied gas of propane to butane are the products by which the firm foundation of the natural gas and bottle gas industry, respectively, have been founded.

Dry natural gas and more recently bottled gas have been used as a fuel and source of energy and their expanding use in these fields should be accelerated by the recent development of the combustion gas turbine.[1] In addition, Servel's all-year gas-operated air conditioner and the modern gas operated radio are examples of the many domestic and industrial duties this perfect fuel may perform. In addition to its energy use dry natural gas and bottle gas combined with the non-hydrocarbon group may be used as raw materials for the production of synthetic organic chemicals from which many useful products of today may be manufactured.

It is very difficult to report the many chemical products which may be manufactured from natural gases in that the industry is developing so rapidly. For a very thorough and up to date discussion of these products reference is made to the work of Smith[2] who has presented this information in a very satisfactory manner by the use of charts.

The non-hydrocarbon constituents, with the exception of carbon dioxide, are found in natural gas in relatively small amounts. Hydrogen sulphide, which is objectionable due in part to its corrosive nature, may be removed and marketed for agricultural uses. The extremely fine state in which the sulphur is recovered has special value both in liquid sprays and as a solid dusting material. Helium, although present in natural gas in small amounts, is nevertheless of great value, as an oxygen diluent for medical purposes, inflation of lighter than air balloons and ships, as a preservative, and in the electric industry. Some wells produce carbon dioxide in relatively large amounts and make possible its recovery and use as a refrigerant, fire extinguisher, food preservative and beverage carbonator.

The hydrocarbon groups of dry natural gas and bottle gas which are byproducts of the natural gasoline industry must be converted into other products before they may be used to manufacture useful products. There are four methods of conversion, namely: decomposition, oxidation, halogenation and nitration.

Decomposition consists of splitting the hydrocarbon by thermal, catalytic and electric means. Processing natural gas by this method yields many synthetic raw materials which may be used in the production of many products, chief of which are plastic, synthetic rubber, motor fuel, explosives, dyestuffs and hydrogenated vegetable and mineral oils.

From Circular 1708 Bureau of Mines

Chart 1, reported by Smith,[2] gives some of the chemical products produced by oxidation. Oxidation may be defined as the introduction of oxygen into the hydrocarbon molecule by the aid of heat and catalysts. This method insures the production of many alcohols, aldehydes, ketones and ethers which are the chemical raw materials of many modern products.

Halogenation consists of the reaction of the hydrocarbon molecule with a member of the halogen family, this reaction being activated by heat, catalysts and light. The many chemical products formed by this process are useful as refrigerants, solvents, medicine, insecticide, fire extinguishers, and flotation agents. Chief of these useful products could be tetraethyl lead, an anti-knock compound; vinyl chloride and vinyl acetate for the manufacture of plastics and sodium polysulfide used in the manufacture of Thykol, a rubber substitute.

Nitration defines the method by which hydrocarbon gases and nitric acid in the vapor phase are allowed to react and by the aid of heat a series of nitro-compounds[3] are formed, such as nitromethane, nitroethane, nitropropane and nitrobutane. These compounds find use as organic reagents and recently as raw material for explosives. Nitromethane reacts with formaldehyde to form a product that when acted on by nitric acid produces an explosive nitroisobutylglycerine trinitrate. This compound is reported to be more stable than TNT and the future of this explosive appears to be very promising. The many products which may be manufactured from these nitro-compounds are varied, such as: rubber accelerators, chloropicrin and plastics. Commercial Solvents Corporation has started commercial production of these nitro-paraffins in addition to a long list of their derivatives. The development of the nitro compounds has just started and it is predicted[4] that these agents will create a new and dynamic branch of industrial and organic chemistry.

As previously stated and reported[2] many raw materials may be obtained by the decomposition or cracking of natural gas, included under this classification is the method of dehydrogenation. Methane, a major constituent of natural gas can be cracked to give unsaturated gases and aromatic liquids, but at present the methods available are extremely difficult and inefficient. Under these conditions, methane is at present used as a major raw material to produce hydrogen for hydrogenation

---

[1] *Portion of paper presented before the 1941 Convention of the Natural Gasoline Association of America held at Dallas, Texas, April 23-25, 1941.*

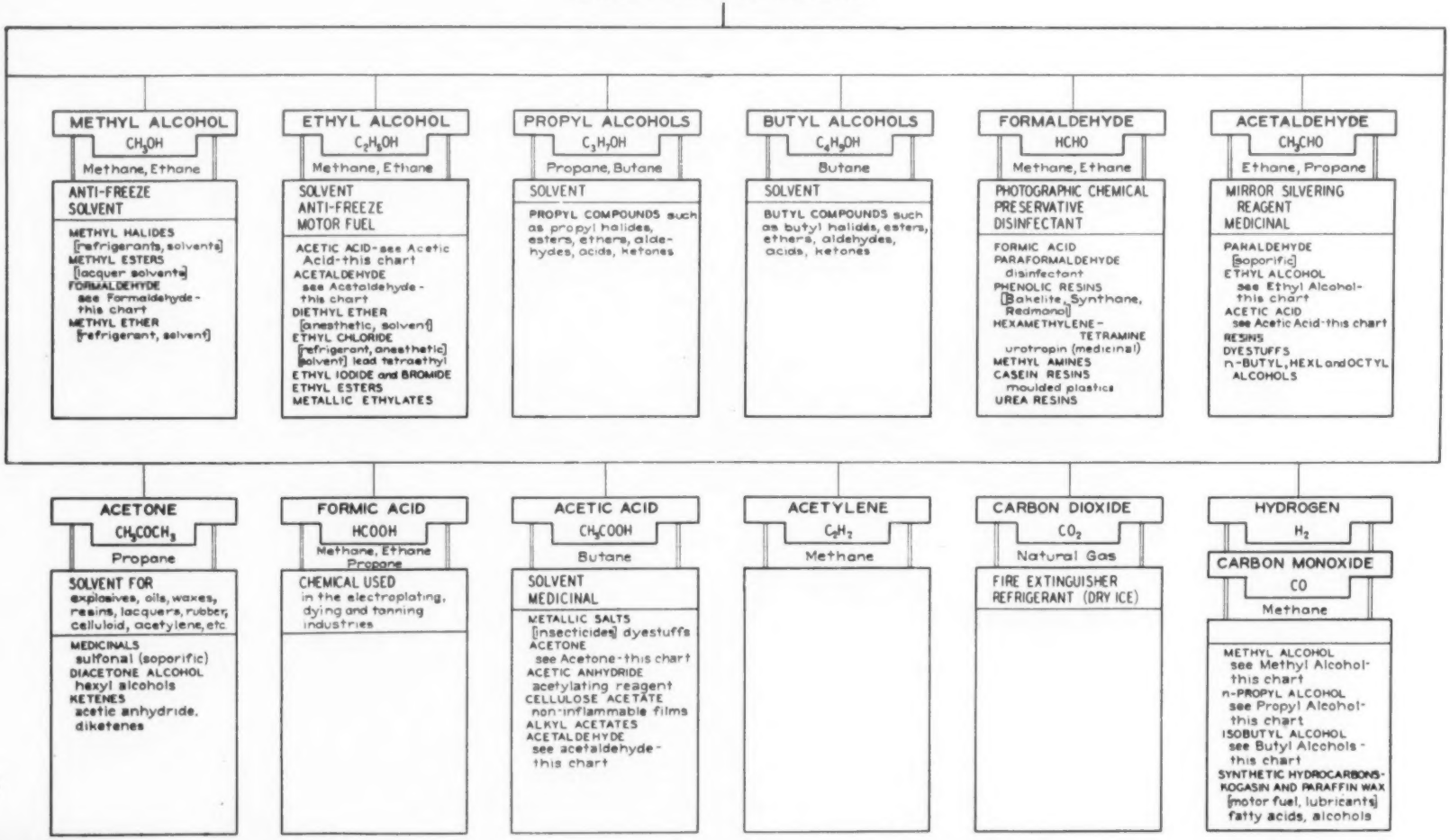
CHART I

PRODUCTS OBTAINABLE FROM NATURAL GAS HYDROCARBONS

BY

OXIDATION

THERMAL-CATALYTIC-PRESSURE



purposes and in the manufacture of carbon as a pigment in ink, paint, and as a filler in compounding rubber.

Ethane and the heavier hydrocarbons however, produce many olefine hydrocarbons on being cracked. It is reported[4] that one chemical company is producing from these olefines, more than one hundred products including, twenty-four different kinds of alcohols, four ketones, twenty-three esters, thirteen amines, and thirty-five other chemicals.

The dehydrogenation and polymerization of natural gas is now being used by oil companies throughout the country to produce super anti-knock gasolines. Recent advances in this field is the announcement of Neohexane, a new synthetic hydrocarbon manufactured by thermal alkylation of isobutane and ethylene. Phillips Petroleum Company[5] have announced this new product which has now outgrown its pilot plant and is in commercial production at Borger, Texas. This fuel has an octane rating of only 94, however, its high lead susceptibility and high volatility make possible the production of fuels with 115 octane rating. This 100 octane plus fuel dictates better engine performance and economical operation for long distance flying, however, the potentialities of this new fuel will not be known until higher compression engines are available. This development is merely the introduction of things to come in that this fuel may soon be made by catalytic methods, which in turn may introduce fuels with higher octane-ratings. Thus a new chapter in aviation fuel production may be made possible by the large volumes of an inexpensive raw material, natural gas.

During the past two years much has been heard relative to synthetic Buna rubber in Germany, Italy and Russia. Present day conditions, reflecting possible decreases in import rubber supply, have centered interest on synthetic rubber and its raw materials here in the United States.

The basic raw material for Buna type rubbers is butadiene. This diolefin is made in Germany by a synthetic process using acetylene as a raw material obtained from carbide. Italy produces butadiene from alcohol. Although these raw materials are available in the United States the major production of synthetic rubber apparently will be from natural and refinery gases.

In addition to butadiene the other raw material required in the production of Buna type (Perbunan) rubbers is acrylonitrile, Chart 2. This material is in commercial production by the Carbide and Carbon Chemical Corporation[6] and it is understood that Dow Chemical Company will soon start production on this material. Production of this type of rubber is now being carried on by Standard Oil Company of Louisiana at Baton Rouge and Firestone at Akron, Ohio.

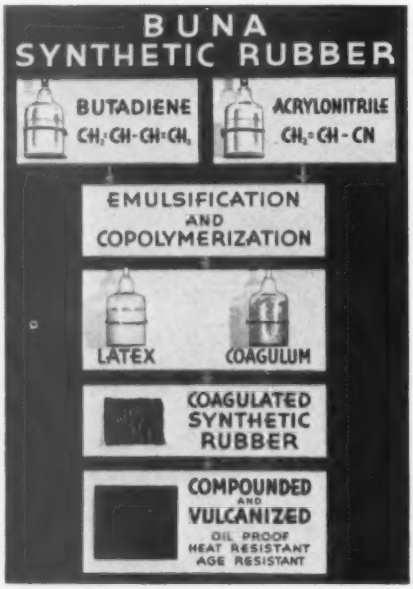


CHART II

This chart, exhibited at the Patent Law Sesqui-centennial in Washington, D. C., traces the major steps in the production of buna, a synthetic rubber now being manufactured by The Firestone Tire & Rubber Company.

Courtesy Firestone News Bureau

Of the various types of buna rubbers produced it has been reported[7] that only two are being considered by Firestone. Buna N, or Perbunan, will go into immediate production at Akron, Ohio. This product will not compete with natural rubber due to its cost being two to four times greater. Instead new markets will be created where buna's high resistance to swelling and deterioration when in contact with oil and gasoline, makes it ideal for gaskets, hose and other industrial applications. In addition, its excellent insulation qualities and superior resistance to abrasion make it highly practical in many fields. Of the materials used in perbunan rubber approximately eighty percent is butadiene. Acrylonitrile produced from coal tar is added. In the production of buna S the same proportion of butadiene is mixed with styrene. Buna S used abroad in automobile tires, will possibly play a minor role in tire production in the United States because of its very high production cost.

Goodyear has announced Chemigum, a butadiene polymer to be in semi-commercial production. Latest reports are that the new plant will soon be in operation at Akron, Ohio. Standard Oil Development Company has recently announced a new product, Butyl Rubber, consisting of polymerized butadiene and butene.

The Hydrocarbon Chemical and Rubber Company sponsored by B. F. Goodrich Company and Phillips Petroleum Company, is now producing a butadiene synthetic under the name Hycar. Hycar is a synthetic rubber produced by polymerization of butadiene. This product was developed to fulfill the demands for flexible articles resistant to oils, fats and aliphatic hydrocarbons, heat and oxidation. In addition it is reported[6] that Goodrich has constructed a plant at Niagara Falls to produce Koroseal, a plasticized polyvinyl chloride. This compound covers a wide range of uses, including insulation for electric wires, chemical and oil resistant hose, wrapping material, and fabric coating.

The newer type of synthetic rubbers all require butadiene and production of this compound is rapidly increasing. In addition to the source of production previously listed the following companies are entering the field or increasing their production rate, Dow Chemical Company, Shell Development Company, and the Carbide and Carbon Chemical Corporation.

Neoprene, an entirely new engineering material, is now being produced by du Pont. This product cannot be called synthetic rubber because it is different in chemical composition and cannot be correctly termed a rubber substitute because it has physical properties that make it superior to rubber under certain conditions. Neoprene is being used by rubber manufacturers to replace many other materials in service where its superior properties, such as resistance to many chemicals, heat, sunlight, and oil make its use desirable. This compound has not only replaced rubber in many cases, but may also be satisfactorily used as a substitute for bakelite, leather, waxes, metals, fabrics and other similar compounds.

This new product of du Pont, Choroprene Rubber, is now being manufactured from the following raw materials, coal, limestone, and

Courtesy du Pont Company

Mill used for washing neoprene at the Deepwater Point (N. J.) plant of E. I. du Pont de Nemours & Company.

salt. The coal and limestone produce calcium carbide from which acetylene is obtained. By means of catalyst the acetylene is converted into monovinylactylene, this being treated with hydrochloric acid, made from salt, produces choroprene which is then polymerized to form Neoprene. Here again we have a new product of great potentialities manufactured from acetylene, which in turn, may be produced from natural gas.

The rapid development of the plastic industry is attracting widespread attention and this astonishing growth is clearly verified by the report[8] that this industry has increased thirty-six fold since 1922. This phenomenal growth has been made possible by research work and the availability of large quantities of inexpensive raw materials.

In the manufacture of plastics, on the basis of raw materials employed, three classifications may be used: natural resins, semi-synthetics, and synthetics. Natural resins have been used by man for many years. Semi-synthetics defines the group of high molecular weight products such as isomerized rubber, manufactured from natural rubber supplied by nature. Synthetic plastics, as named, covers the products manufactured by chemical synthesis starting with low molecular weight chemicals. In this group are found plastics derived from hydrocarbon gases.

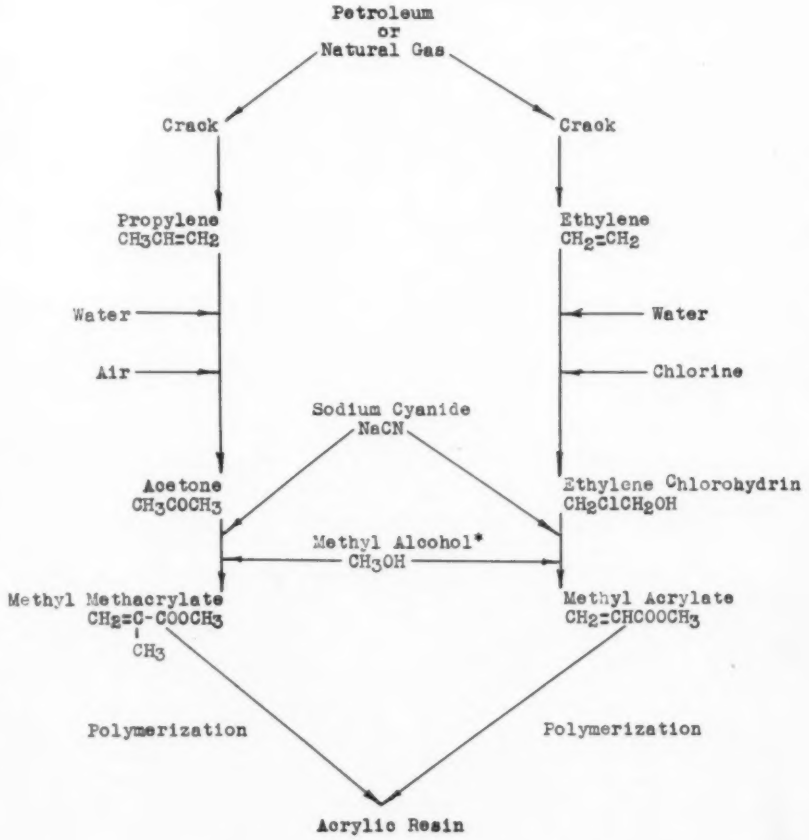
Ethylene, is an important raw material for many types of synthetic resins. This material used in the production of many plastics is obtained from cracked natural gas and refinery gas.

England faced with a shortage of material for cable sheathing, in that polyvinyl chloride formerly imported from Germany was used for this purpose, has developed one of the latest type of plastics, Polythene. This product is made by the direct polymerization of ethylene and possesses rubber-like qualities and excellent insulating characteristics.

Ethylene is the source of an important group of plastics based on vinyl chloride. Vinyl chloride may be manufactured from ethylene by the direct addition of hydrogen chloride to acetylene. In addition and closely related to ethylene chloride is vinyl acetate. This compound is now chiefly manufactured from acetylene and acetic acid, the acetylene being produced from carbide, however, the future should see large quantities of acetylene, used in this process, produced from natural gas. These compounds, together with polyvinyl butyral, are being marketed and sold in varying proportions under the name of Vinylite Resins a product of Carbide and Carbon Chemicals Corporation.

Vinyl chloride may be polymerized and then plasticized to form a commercial product, Koroseal, previously mentioned. This product of industrial and commercial use replaces rubber for applications dictating resistance to sunlight, acids and where good flexing and aging characteristics are required.

Vinyl acetate may be polymerized to a product called polyvinyl acetate possessing unique adhesive properties, such as "Viny seal," a thermoplastic type of adhesive, an excellent binding agent for artificial wood. Vinyl chloride and vinyl acetate may be mixed in varying proportions and polymerized together to give products of widely different commercial uses. When a product is obtained by using 85 per cent chloride and 15 per cent acetate an injection molding powder may be obtained, an example of such a related compound is Series V of Vinylite Resins. This



*Note: By substitutuing other alcohols at this point, other esters of acrylic acid are obtainable. Varying the relative amounts of these esters and control of polymerization conditions yields resins varying from tacky liquids to hard solids, (Courtesy of Rohm and Haas Company.)

CHART III

resin may be obtained in the form of injection molding and compression molding plastics, vinylite coated paper, rods and tubes, and as base resins for surface coating formulations. An interesting application[8] of this series of resins, is the so-called "Keglined" beer cans.

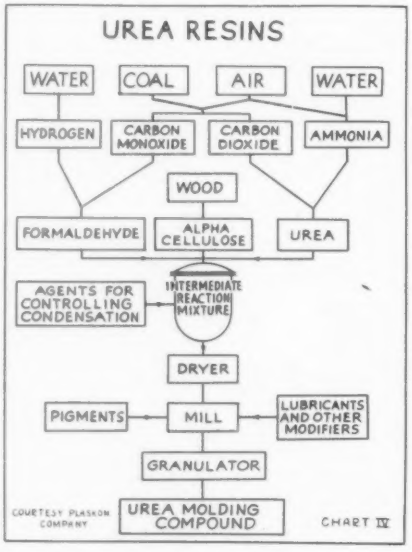
The most amazing development in this new field of resins is the entrance into the textile field. When the percentage of vinyl chloride is 90 per cent and mixed with vinyl acetate and then polymerized to give a compound with a molecular weight of about 20,000, a new substance, Vinyon is formed. This product has unique film and filament forming properties, making possible the production of Vinyon filter cloth, bathing suits and other textile products. The unusual properties of Vinyon have been listed[9] and some of the outstanding ones are: it will not support combustion, bacteria or fungi growth, and it is highly resistant to many organic and inorganic chemicals. A special procedure by which Vinyon may be satisfactorily dyed has been perfected and adds to the usefulness and desirability of this product. Vinyon may be produced from two raw materials, natural gas and salt.

Vinyl compounds are also available in the heavier form such as Polyvinyl Butyral, four carbon atoms, this compound is marketed under the name of vinylite resins, series X. This compound is of extreme value in the manufacture of newest type safety glass because of its great strength and toughness particularly at low temperatures. This new product has within the period of two years replaced cellulose acetate in almost all the safety glass that is used in automobiles.

In synthetic resins, the acrylics are outstanding by their outstanding colorless transparency, chemical resistance, and stability against aging and weathering. These resins are produced by du Pont and Rohm and Haas Company. This product is manufactured by complicated chemicay synthesis, Chart 3, from raw materials such as natural gas or petroleum, salt, air and water. These resins range in consistency from soft, tacky semi-liquids to hard, tough thermoplastic solids. These variations are produced by controlling manufacturing conditions rather than by substitution or addition of plasticizers which in turn may produce taste, odor, instability or flaws in the product. The crystal clarity of these resins is made possible by purity of raw materials, cleanliness in equipment, and satisfactory manufacturing procedures.

These acrylics are available in many forms, an unusual combination of properties dictates their use in many fields. In aqueous emulsions and solutions in organic solvents, they find use as flexible, permanent finish for textiles and leather; as adhesives, and as a laminating layer for safety glass. Under the trade name Crystalite these resins are used as a molding powder to manufacture industrial and decorative parts.

One of the most interesting and important applications of these resins is their use as Plexiglas. This product is one of the hardest acrylic resins, a colorless, transparent, thermoplastic solid. In addition it may



be obtained in a number of colors, both transparent and translucent, varying from delicate tints to the deep shades. The thermoplastic property of Plexigas makes possible its fabrication at ordinary temperatures attained in ordinary ovens. By the use of wood tools it may be readily machined.

The optical properties of Plexiglas are of extreme interest in that it is more transparent than optical glass, transmitting every color of the spectrum fully and its light transmission of 92%, relative to 88% for good glass, make it difficult to photograph and often invisible. In addition it is transparent to ultra-violet rays down to 300 millimicron, with 90% efficiency and also transmits infra-red and X-rays. These exceptional properties of Plexiglas promote its use as medical instruments. Optometrists make use of these unique properties to produce Plexiglas contact lenses to be worn by sportsmen and actors and others who wish to avoid wearing glasses. The contact lenses are made to fit the eyeball and then ground to give the proper corrective curvature and it has been reported that these lenses may be used without toxic effect to the eye.

The excellent insulating properties of Plexiglas make it desirable in electrical applications where high dielectric strength is required. Lamps and lighting fixtures may be produced and used with a greater degree of safety.

The light weight, high impact strength and permanent colorless transparency of Plexiglas is used to advantage in the production of aircraft parts. These excellent properties of Plexiglas allow it to be used in the form of transparent curved sections of the plane, as cockpit enclosures, gun turrets and landing light covers, as well as windows and windshields. Plexiglas products are now standard equipment on all types of military, transport and private planes Plexiglas, combining the transparency of glass with the strength of a synthetic plastic should be of ever increasing use as a product of commercial, scientific and industrial application.

Urea resins increased in production during the year of 1940 over the previous year. This increase in production in part may be attributed to their introduction into the field of baking enamels in 1937. Baking finishes are being made by Rohm and Haas, Reichold Chemicals, Libbey Owens-Ford Glass Company, Bakelite Corporation and the American Cyanamid and Chemical Corporation. The last three of these organizations are also in the molding plastic field.

Plaskon Company, sponsored by the Libbey-Owens-Ford produces a molding material under the trade name of "Plaskon." This material is manufactured from urea, formaldehyde, filler, pigment and plasticizing agents, Chart 4. It should be noted that the formaldehyde is obtained from carbon monoxide and hydrogen, however, it is commonly stated that in Russia formaldehyde is being produced in considerable amounts by controlled oxidation of methane from natural gas. In addition it has been reported[7] that in this country formaldehyde is being produced as a byproduct in a process for the removal of oxygen from natural gas in transmission operations.

(Continued on page 40)

THE ORIFICE METER

A Product of Cooperation Within An Industry

A. D. MacLean

By

Allen D. MacLean

Vice President and Chief Engineer
Pittsburgh Equitable Meter Co.

THE OLD BARD who coined the phrase — "Necessity is the mother of invention" would be forced to change his wording somewhat if he lived in modern times. "Necessity is the mother of development" more nearly fits the facts in most of our recent advances. Invention,—pure invention,—is becoming much rarer in our industrial life; development,—in its true and broad sense,—more nearly describes the process by which the tools and appliances of industry are furnished.

No one development illustrates this fact better than the orifice meter as used by the gas industry. It would be impossible to name the "inventor" of the modern orifice meter. We might name a few mechanical parts of the whole instrument for whom some one individual might receive credit as inventor; but the instrument as a whole in its application to the job of measuring was developed. It was developed not by one man, or even one group of men. It is a fine example of cooperation between many sides of industry; the physicist, the mathematician, the instrument builder, the various engineering societies, the universities, governmental agencies, and last but not least, the gas companies themselves. It required the services of all these groups individually and it required a unification of their efforts to produce the very excellent measuring device we now call the orifice meter.

The necessity for the orifice meter in the early days of the natural gas industries development was indeed pressing. The diaphragm meter, which had served to measure small flows quite efficiently, had certain mechanical limitations as to size: the proportional meter, employing the diaphragm meter as a tally device, had limitations as to accuracy in proportioning the flow which seemed to be insurmountable. The pioneer seized upon the flat plate orifice meter as a probable device which could be developed into a serviceable meter and from that point on the development was sure and methodical, though perhaps at some stages slow.

In looking back over the development and use of the orifice meter, four groups of men have contributed generously. First we have the physicist, who pointed out the principle of the meter, and developed the simple formula to explain the principle. Second, there had to be a mathematician to make the formula applicable to practice and to reduce to usable terms the vast amount of experimental work necessary in the development of the flat plate orifice as a measuring device. Third, the engineer or constructor was relied upon

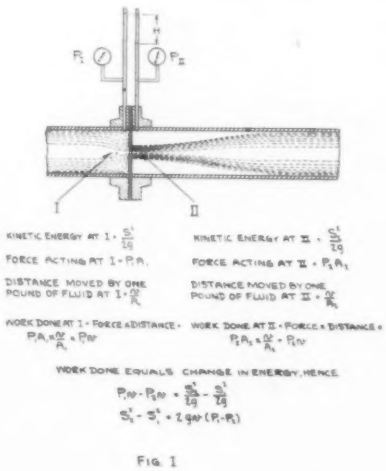

P1
P2
I
II
KINETIC ENERGY AT I = S1²/2g
KINETIC ENERGY AT II = S2²/2g
FORCE ACTING AT I = P1A1
FORCE ACTING AT II = P2A2
DISTANCE MOVED BY ONE POUND OF FLUID AT I = w/A1
DISTANCE MOVED BY ONE POUND OF FLUID AT II = w/A2
WORK DONE AT I = FORCE × DISTANCE = P1A1 × w/A1 = P1w
WORK DONE AT II = FORCE × DISTANCE = P2A2 × w/A2 = P2w
WORK DONE EQUALS CHANGE IN ENERGY, HENCE
P1w - P2w = S2²/2g - S1²/2g
S2² - S1² = 2gw(P1-P2)

FIG. 1

to work out the practical problems of runs, approach sections, flanges, manifolds, and also develop the instrument by which the necessary functions of flow could be recorded, and last, once the instrument became a working unit, a group to translate and record the results in actual usable figures such as total number of cubic feet, at a defined set of base conditions. To really understand the fundamentals of the orifice meter, the work of each of these four groups should be studied,—for each contributes an important part in successful measurement with the orifice meter.

First, the physicist,—for he it was who called attention to the phenomenon that when a fluid,—liquid or gas, is made to pass through any restriction such as an orifice plate, some important changes in pressure takes place, and these pressure changes might serve as a basis for evaluating the rate of flow. The physicist, observing the phenomenon would not be content until he could express it in some sort of general formula which would predict the relation under all conditions. The approach he used, so often used in work involving moving fluids, was to study the energy relation existing throughout the vicinity of the orifice.

It is obvious that if we move a certain number of pounds of fluid through the metering section in a given time, that when the fluid passes through the reduced orifice area it must at least momentarily increase its velocity. Fig. I will give us the mathematics of this relation. In Fig. I, at position I we have the fluid moving at a normal rate; but at II because the flow stream is smaller the fluid must speed up. The kinetic energy possessed by a unit of the fluid at I is $\frac{S_1^2}{2g}$ where S is the velocity in feet per second at I; at II the kinetic energy is $\frac{S_2^2}{2g}$.

The actual force exerted on a film of the liquid at I is $P_1 \times A_1$, where P_1 is the pressure at I and A_1 is the pipe area, for the total force pushing the film is its area multi-

plied by the pressure; similarly at II, in pushing a film of the liquid along the force is $P_2\ A_2$ where P_2 is the pressure at II, and A_2 is the area at II.

Now one pound of fluid in passing through A will move a distance of $\frac{v}{A_1}$ feet where v is the specific volume of the fluid in cubic feet per pound, i.e. is distance moved by the pound is the number of cubic feet in a pound divided by the area A_1 in square feet.

Work is defined as force multiplied by distance, thus when a pound of fluid passes at A_1 the work done on the pound is $P_1\ A_1 \times \frac{v}{A_1} = P_1\ v$, and at II, by the same reasoning will be $P_2\ v$.

The physicist also knows from the law of the conservation of energy that any work done between these points, eliminating heat losses, will be equal to the change in energy. Thus he can write

$$P_1\ v - P_2\ v = \frac{S_2^2}{2g} - \frac{S_1^2}{2g}$$

or simplifying $S_2^2 - S_1^2 = 2gv\ (P_1 - P_2)$.

If we measure pressures P_1 and P_2 by the height to which the fluid will rise in a gauge glass, this will be $P_1\ v$* at I and $P_2\ v_2$ at II. If we denote the difference in head by H, we can write $S_2^2 - S_1^2 = 2gH$. This then is the fundamental formula relating velocity to pressure loss, as shown in Fig. II.

If we let Q' equal the rate of flow in cubic feet per second, then

$$S_1^2 = \frac{Q'^2}{A_1^2}$$

and

$$S_2^2 = \frac{Q'^2}{A_2^2}$$

Substituting

$$\frac{Q'^2}{A_2^2} - \frac{Q'^2}{A_1^2} = 2gH$$

Rewritten

$$Q' = \frac{A_1\ A_2}{\sqrt{A_1^2 - A_2^2}}\sqrt{2gH}$$

If D_1 = diameter of the pipe at I and D_2 = the diameter at II, and $\frac{D_1}{D_2} = \beta$ we can rearrange the equation to

$$Q' = A_2 \frac{1}{\sqrt{1-\beta^4}}\sqrt{2gH}$$

Practically we can see from this formula something which the physicist probably suspected when he started,—that the flow rate varies with the square root of the differential pressure across the plate.

Our physicist has given us a fairly workable formula, expressing Q', the rate of flow in cubic feet per second as a function of A_2 the orifice diameter, β the ratio of orifice diameter to pipe diameter and H the loss in head across the plate.

At this point the mathematician steps in. He realizes that a more practical unit of flow is cubic feet per hour and thus writes

Q = rate of flow in cubic feet per hour = $3600\ Q'$.

Also, the practical mathematician knows that almost all formulae arrived at by pure reasoning must be modified by practical considerations. Turbulence of flow in the vicinity of the orifice and through it, will cause some energy or heat losses. Also he will observe the smallest area at the flow stream, at which point we will measure pressure, is actually, because of the flow pattern, a little smaller than the actual orifice area. These facts will somewhat modify the practical equation, and it becomes evident that to get true practical results a large number of tests must be run to evaluate these unknowns. The mathematical trick for relating the physicist's theoretical value to the practical value obtained by tests is to put an efficiency factor E in the equation, and attempt to arrive at an expression to evaluate E later. We can also include the value of $\frac{1}{\sqrt{1-\beta^4}}$ in this factor E. As a further practical thing, he feels that the orifice area A_2, which up to now has been area in square feet can be more useful if expressed as a function of the orifice diameter d in linear inches. This we can accomplish by writing

$$A_2 = \frac{\pi}{4} \times \frac{d}{144}$$

So the practical mathematician writes

$$\frac{Q}{3600} = E \frac{\pi}{4} \times \frac{d^2}{144}\sqrt{2gH}$$

or

$$Q = 19.64 E d^2 \sqrt{2gH}$$

Now continuing the work of evolving a practical and workable formula, we must find some way of expressing H, the pressure difference across the plate. In the physicists work he expressed H as a head of the flowing fluid. In gas work this would be impractical. In casting around for a convenient method of expressing this pressure difference, water seemed to be the most logical medium of expressing pressure difference. It is found universally, and can be used practically in checking the instrument used to record this differential pressure. The mathematician, knowing the weight of water exactly and knowing the weight of air, to which all gas weights are referred through the medium of the specific gravity, is able to write as in Fig. III this pressure relation by the following formula:

$$H = \frac{h}{12} \times \frac{62.37}{.08073 \times G}$$

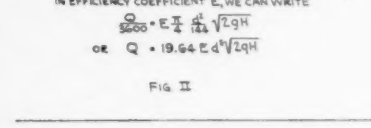

H = P₂v − P₁v
S₂² − S₁² = 2gH
Q' = RATE OF FLOW IN CUBIC FEET PER SEC.
THEN S₂² = Q'²/A₂² S₁² = Q'²/A₁²
Q'²/A₂² − Q'²/A₁² = 2gH
Q' = A₁A₂/√(A₁²−A₂²) √2gH
A₂/A₁ = (D₂/D₁)² = (β)²
Q' = A₂ 1/√(1−β⁴) √2gH
Q = RATE OF FLOW IN CUBIC FEET PER HOUR = 3600 Q'
A₂ = π/4 × d²/144 WHERE d = ORIFICE DIAM. IN INCHES
INCLUDING VELOCITY OF APPROACH FACTOR 1/√(1−β⁴)
IN EFFICIENCY COEFFICIENT E, WE CAN WRITE
Q/3600 = E π/4 d²/144 √2gH
OR Q = 19.64 E d² √2gH

FIG. II

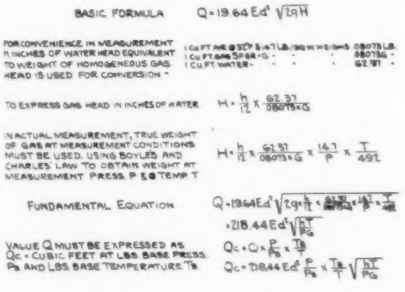

BASIC FORMULA Q = 19.64 Ed² √2gH
FOR CONVENIENCE IN MEASUREMENT H INCHES OF WATER HEAD EQUIVALENT TO WEIGHT OF HOMOGENEOUS GAS HEAD IS USED FOR CONVERSION
1 CU FT AIR @ 32°F & 14.7 LBS/SQ IN WEIGHS .08073 LB.
1 CU FT GAS SP GR "G" " " " " .08073 G "
1 CU FT WATER " " " " 62.37 "
TO EXPRESS GAS HEAD IN INCHES OF WATER H = h/12 × 62.37/.08073G
IN ACTUAL MEASUREMENT, TRUE WEIGHT OF GAS AT MEASUREMENT CONDITIONS MUST BE USED. USING BOYLES AND CHARLES LAW TO OBTAIN WEIGHT AT MEASUREMENT PRESS. P & TEMP T
H = h/12 × 62.37/.08073G × 14.7/P × T/492
FUNDAMENTAL EQUATION
Q = 1964 Ed² √2g h/12 × 62.37/.08073G × 14.7/P × T/492
= 218.44 Ed² √h/PG
VALUE Q MUST BE EXPRESSED AS Qc = CUBIC FEET AT LBS. BASE PRESS. Pb AND LBS. BASE TEMPERATURE Tb
Qc = Q × P/Pb × Tb/T
Qc = 218.44 Ed² P/Pb × Tb/T √h/PG

FIG. III

Practically we can see from this formula something which the physicist probably suspected when he started,—that the flow rate varies with the square root of the differential pressure across the plate.

Our physicist has given us a fairly workable formula, expressing Q', the rate of flow in cubic feet per second as a function of A_2 the orifice diameter, β the ratio of orifice diameter to pipe diameter and H the loss in head across the plate.

At this point the mathematician steps in. He realizes that a more practical unit of flow is cubic feet per hour and thus writes

Q = rate of flow in cubic feet per hour = $3600\ Q'$.

Also, the practical mathematician knows that almost all formulae arrived at by pure reasoning must be modified by practical considerations. Turbulence of flow in the vicinity of the orifice and through it, will cause some energy or heat losses. Also he will observe the smallest area at the flow stream, at which point we will measure pressure, is actually, because of the flow pattern, a little smaller than the actual orifice area. These facts will somewhat modify the practical equation, and it becomes evident that to get true practical results a large number of tests must be run to evaluate these unknowns. The mathematical trick for relating the physicist's theoretical value to the practical value obtained by tests is to put an efficiency factor E in the equation, and attempt to arrive at an expression to evaluate E later. We can also include the value of $\frac{1}{\sqrt{1-\beta^4}}$ in this factor E. As a further practical thing, he feels that the orifice area A_2, which up to now has been area in square feet can be more useful if expressed as a function of the orifice diameter d in linear inches. This we can accomplish by writing

$$A_2 = \frac{\pi}{4} \times \frac{d}{144}$$

So the practical mathematician writes

$$\frac{Q}{3600} = E \frac{\pi}{4} \times \frac{d^2}{144}\sqrt{2gH}$$

or

$$Q = 19.64 E d^2 \sqrt{2gH}$$

Now continuing the work of evolving a practical and workable formula, we must find some way of expressing H, the pressure difference across the plate. In the physicists work he expressed H as a head of the flowing fluid. In gas work this would be impractical. In casting around for a convenient method of expressing this pressure difference, water seemed to be the most logical medium of expressing pressure difference. It is found universally, and can be used practically in checking the instrument used to record this differential pressure. The mathematician, knowing the weight of water exactly and knowing the weight of air, to which all gas weights are referred through the medium of the specific gravity, is able to write as in Fig. III this pressure relation by the following formula:

$$H = \frac{h}{12} \times \frac{62.37}{.08073 \times G}$$

---

* The value P_1v as an expression of pressure at the gauging point is derived as follows. Assume area of gauge glass to be a, and the height to which the fluid rises is b, then the volume of fluid in the glass is ab; the weight of the fluid in the gas is $\frac{ab}{v}$. This weight must exactly equal the upward force due to pressure and this upward force is a P_1.

$$a\ P_1 = \frac{ab}{v}$$

or $b = P_1v$ = height to which fluid rises in gauge glass.

where

h = height of differential in pressure in inches of water.

$\frac{h}{12}$ = height of differential pressure in feet of water.

62.37 = weight of a cubic foot of water.

.08073 = weight of a cubic foot of air.

G = specific gravity of the gas being measured in reality is the ratio of weight of a cubic foot of gas to a similar cubic foot of air.

The value .08073 × G is in reality the weight of a cubic foot of gas at standard condition of 14.7 pounds per square inch and an absolute temperature of 492° F. If we measure the gas at some absolute pressure which we will call P and absolute temperature T, the real density of the gas being metered will be (according to Boyle's and Charles' Law)

$$.08073 \times G \times \frac{P}{14.7} \times \frac{492}{T}$$

Then

$$H = \frac{\frac{h}{12} \times \frac{62.37}{.08073 \times G}}{\frac{14.7}{P} \times \frac{T}{492}} \times$$

Now by substitution we can write the general flow formula

$$Q = 19.64Ed^2\sqrt{2g \times \frac{h}{12} \times \frac{62.37}{.08073 \times G} \times \frac{14.7}{P} \times \frac{T}{492}}$$

or

$$Q = 218.44Ed^2\sqrt{\frac{hT}{PG}}$$

Lest we think we are all through and ready to go to work measuring gas with an orifice meter, the mathematician points out that the value Q is the cubic feet of gas at an absolute pressure P and an absolute temperature T. To be of value as a means of expressing gas flows we must put our value of Q in some standardized units. Usually the standard chosen for measurement is a cubic foot at a pressure of 14.4 pounds per square inch absolute, and a temperature of 60° F. (520° F. absolute).

If we let Q_c, then, represent the volume expressed in these units, we can write, using Boyle's Law and Charles' Law,

$$Q_c = Q \times \frac{P}{14.4} \times \frac{520}{T}$$

Further assuming that we are going to set up our coefficients on a basis of air, i.e. G = 1 and assuming the flowing temperature to be 520° absolute we can write

$$Q_c = 218.44Ed^2 \frac{P}{14.4} \times \frac{520}{520}\sqrt{\frac{h \times 520}{14.4 \times 1}}$$

$$Q_c = 345.92Ed^2\sqrt{h\,P}$$

Now we have a more recognizable form of our orifice meter formula as shown in Fig. IV. The factor 345.92Ed² is in reality C′, the factor we usually call the coefficient, so our final workable formula is

$$Q_c = C'\sqrt{h\,P}$$ or the flow rate in cubic feet of air at standard conditions is equal to a coefficient C′ times the square root of the product of the differential pressure across the orifice plate expressed in inches of water head, multiplied by the absolute pressure of the flowing gas in pounds per square inch.

To arrive at a basic condition for purposes of listing coefficient, assume

P_B = Base Pressure = 14.4 Pounds per square inch absolute
T_B = Base Temperature = 520°F absolute
T = Flowing Temperature = 520°F absolute
G = Specific Gravity = 1 (air)

$Q_c = 218.44 \times E \times \frac{P}{14.4} \times \frac{520}{520}\sqrt{\frac{h \times 520}{14.4 \times 1}}$

$Q_c = 345.92\,Ed^2\sqrt{hP}$

$Q_c = C'\sqrt{hP}$ where

C′ is the coefficient derived from published tables

Fig. IV

The evaluation of C′ became the most important job for the mathematical part of our team. For convenience to the industry, it was evident that the determination of C′ for any set of conditions should be based on tables which could be used conveniently for any situation normally met in measurement. First since C′ had to include so many variables in its determination it was only logical to group them. In the determination of our formula certain standard conditions were specified in arriving at the constants used. Any deviation from these constants in the actual job of measuring should be included in the constant C′. Thus pressure base, temperature base, flowing temperature and gravity, if not agreeing actually with the standard conditions used in deriving the formula, should be corrected for by tables. Simple computations provide tables for the correction factors which we will list as follows (as shown in Fig. V.)

P_B = correction for pressure base.

T_B = correction for temperature base.

G = correction for gravity.

T_f = correction for temperature of the flowing gas.

This group of variables present no very great difficulty and the user of the meter can correct for them by a simple factor derived from published tables.

Derivation of Coefficient C′

$C' = F_b \times P_B \times T_B \times T_f \times F_w \times G \times F_R \times Y$

where

F_b = The Basic Factor depending on Orifice Size, Line Size, and Type of Pressure Taps Used.

P_B = Base Pressure Correction Factor

T_B = Base Temperature Correction Factor

T_f = Flowing Temperature Correction Factor

F_w = Supercompressibility Correction Factor

G = Specific Gravity Correction Factor

F_R = Reynolds Number Correction Factor

Y = Expansion Factor

Fig. V

Certain facts were taken for granted in arriving at our mathematical formula, and one of these was that Boyle's Law which expresses the relation between volume and absolute pressure holds throughout the entire range of pressures. Unfortunately, this law has a habit of failing to hold as the pressure increases, and this so-called deviation may become important in its effect on accuracy at the higher ranges. Many tests have been run on the normal gases used and factors have been derived so that for any pressure range the factor correcting for this deviation can be obtained. Thus our

mathematician must evaluate another factor in his final determination of C′, so we have Fpv = supercompressibility factor or correction for the deviation from Boyle's Law.

The biggest task we have, however, is the evaluation of a basic factor for any given size plate in a given line, based on experimental work. At a great many locations over a long period of years, the physicists of the industry accumulated data as to the actual pressure loss across a plate when compared to the flow. This experimental data was carefully studied and plotted in many ways. Certain formulae were devised for the coefficient, based mainly on the orifice diameter and the ratio of orifice diameter to pipe diameter. One was used for flange taps, i.e. pressure taps located in the plate clamping flanges, and another for pipe taps, i.e. pressure reading taps located 2½ pipe diameters upstream from the plate, and 8 pipe diameters downstream. These formulae served well for a while, yet both the physicist and the mathematician knew that certain errors existed in the formulae and their application.

As more data was accumulated and more tests made, it became evident that a higher degree of accuracy was desired, particularly in view of the rapid growth in the use of the orifice meter. Further mathematical studies disclosed the rather disconcerting fact that plotting of observed coefficients against the ratio of orifice diameter to pipe diameter, did not give a smooth continuous curve, but a rather spotted pattern, defying expression by any mathematical law. It was then remembered that pipe line flow characteristics when subjected to a similar investigation defied final conclusions until a certain factor called the Reynolds number* was considered and the data plotted with respect to this number. In using the same reasoning it was suspected that the same factor, the Reynolds number, would influence the flow factor through orifice plates. After a certain amount of mathematical juggling, it was found that once the observed flow coefficients were plotted against a function of the Reynolds number, the curves were more logical, and now instead of a "spotty" pattern, a smooth continuous curve resulted. This was considered a mathematical triumph, but the actual application of this fact to practical measurement offered a disturbing problem. Eventually, again after much juggling of a mathematical nature, certain tables based on differential pressure, static pressure, orifice and pipe diameters were computed which permits the practical application of the Reynolds number by simply multiplying this factor in when computing the coefficient, C′.

Another fact of a physical nature which was somewhat annoying, was that since the pressure of the gas changes as it passes through the orifice section, and since we must use the specific weight of the gas in our computations, there must be some error in neglecting this change in weight. Again our mathematician is called in and tables computed giving the factors by which this variation can be included in the coefficient. This is called the Y factor and is based on the ratio of differential to static pressure, and the ratio of orifice to pipe diameter.

All of the various factors we have just discussed can be included in the coefficient by the following formula.

$$C' = F_B \times P_B \times T_B \times T_f \times F_{pv} \times G \times F_R \times Y$$

where

F_B = the basic factor depending on orifice and line size.
P_B = pressure base correction.
T_B = temperature base correction.
T_f = correction for temperature of the flowing gas.
F_{pv} = correction for supercompressibility.
G = correction for specific gravity.
F_R = Reynolds number correction.
Y = expansion factor correction.

Thus the mathematician has provided us with formulae and tables to arrive at our measurement coefficient for any set of measurement conditions.

In providing the actual equipment for measuring, which job fell to the lot of the engineer, he was forced to recognize certain facts discovered by the physicist and mathematician during their work. Turbulence in the flow stream on the approach side of the orifice will seriously affect the discharge coefficient; therefore certain uninterrupted distances ahead of the plate were recommended and also the use of straightening vanes under certain conditions. The orifice edge, particularly at this upstream side must be sharp to insure a very well defined vena contracta, or minimum flow section. The thickness of the orifice plate must not exceed certain dimensions and it must be set concentric within certain limits. The approach piping must be within certain limits of the true theoretical diameter and should be continuous to within one quarter of an inch of this orifice plate surface.

The tap holes should be carefully made, located accurately with respect to the plate, and be of the recommending diameter. The physical features of the orifice and its surroundings are quite well defined and listed in the A.G.A. Measurement Committee Report No. 2.

The actual meter gauge, used to measure the differential pressure h, and the static pressure P, has taken on a number of forms. An external view of one form is shown in Fig. VI; in this case the gauge is mounted on the main pipe line, and a connecting manifold connects the flanges with the orifice gauge section. This manifold facilitates turning the meter in and out of service, and the running of periodic tests on the differential and static measuring apparatus.

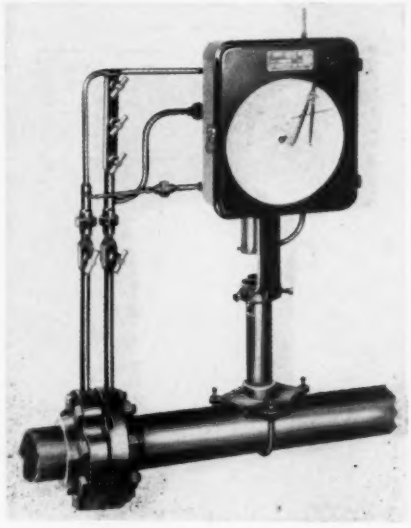
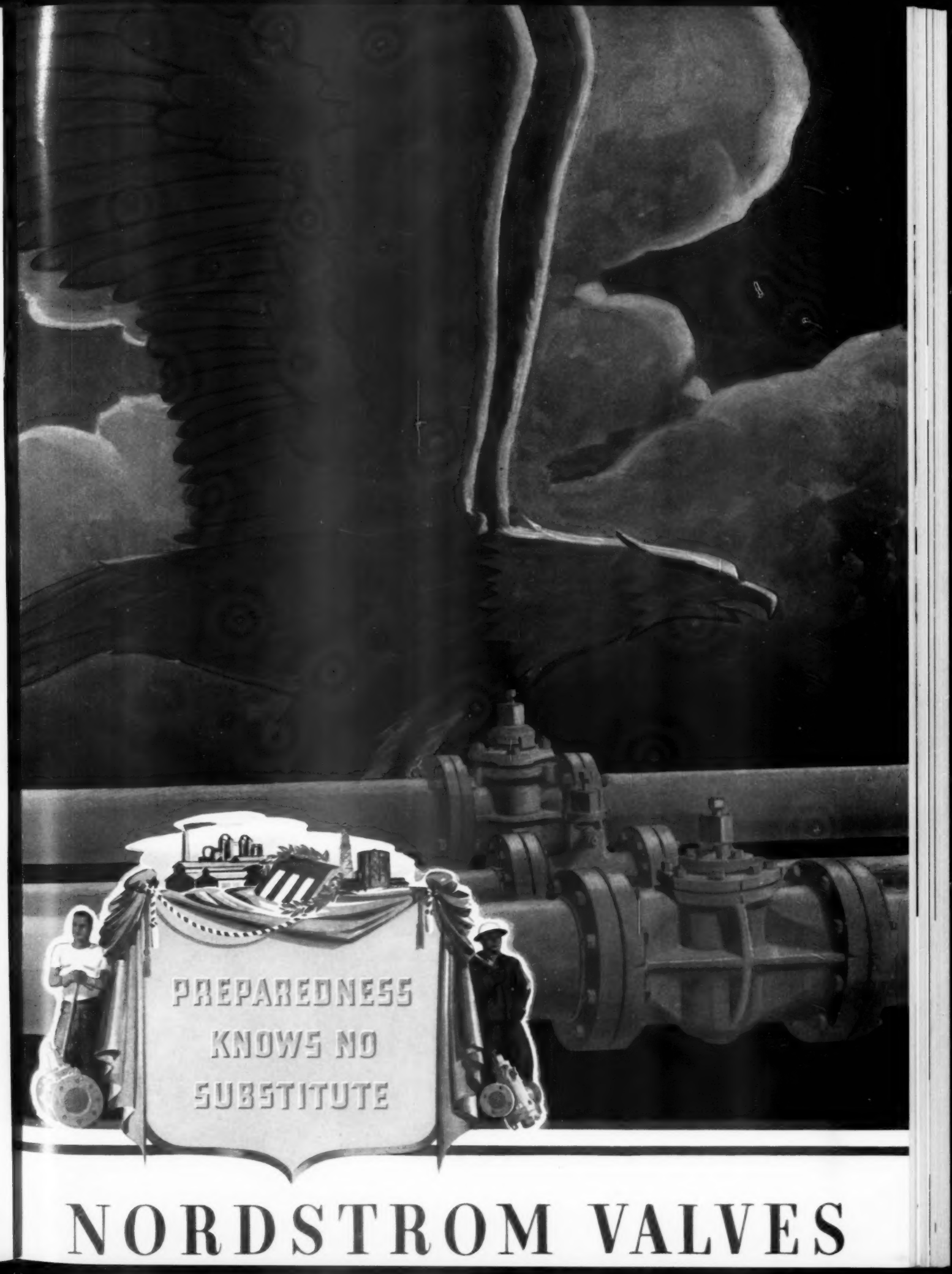


Figure VI. External view of orifice meter.

The differential pressure recording mechanism is shown in Fig. VII. As was pointed out, the differential pressure is expressed in inches of water head, but for mechanical reasons can best be measured using mercury. The mechanism is simply a mercury manometer, of sufficient strength to withstand the pressure and with chambers having diameters calculated to have a given rise of

*The Reynolds number, a purely arbitrary number, which is dimensionless, is defined at $\frac{sd\rho}{\mu}$

where
s = velocity of flowing fluid
d = diameter of orifice
ρ = density of fluid
μ = viscosity of fluid



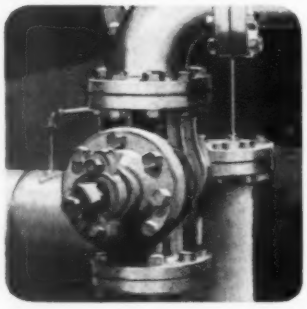
NORDSTROM VALVES

Cavalcade of Valve Progress

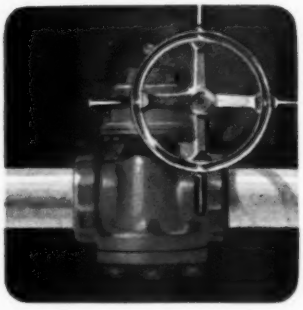
NEVER-ENDING ADVANCEMENT MARKS THE PATH OF NORDSTROM DEVELOPMENT

1905—NORDSTROM BEGINS
Entered mechanical and chemical engineering field. Began construction of plants and mills in various parts of U.S.A. and Mexico.

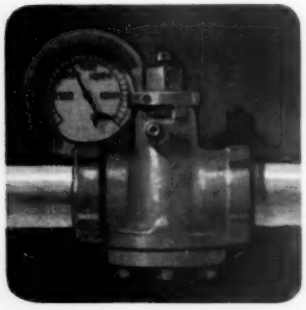
1914—NORDSTROM GETS IDEA
He chanced to stumble over a small corroded plug cock on a cyanide line in Mexico. As a result, invented Nordstrom Valve.



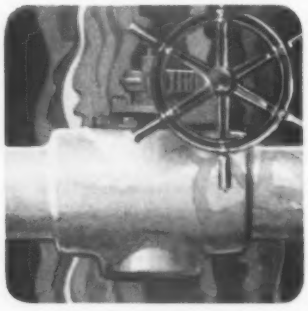
1920—FIRST GAS INSTALLATION
The first Nordstrom gas valve, placed in service in San Jose, California, *(Still operating, as good as new.)*



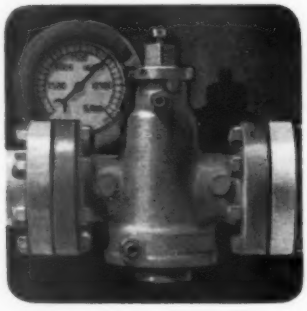
1929—HYPRESEAL DEVELOPED
Experimental work began to develop cast steel valves to meet higher pressures required in oil and gas drilling fields.



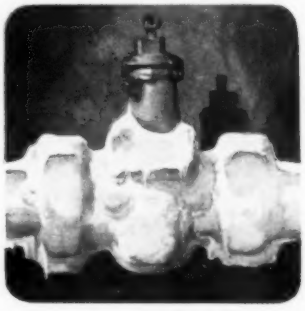
1930—6,000-LB. TEST VALVES
Introduction of Nordstrom Hypreseal Valves for working pressures up to 3,000-lbs., tested to 6,000-lbs.



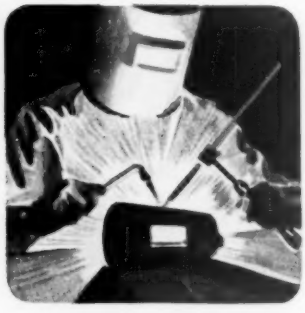
1935—600° F. TEMPERATURE
Lubricants and metals perfected to withstand high temperatures becoming prevalent in new refining operations.



1936—10,000-LB. TEST VALVES
Deeper oil and gas well drilling created demand for 5000-lb. working pressure valves — offered by Nordstrom.



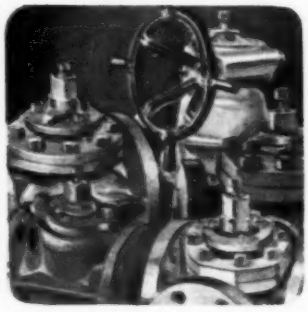
1937—150° SUB-ZERO TEMP.
Chemical and refining processes necessitated sub-zero valves of brittle-resistant alloys. Nordstrom solves problem.



1938—MERCHROMING IDEA
Merchrome Coated Valves with special hard-facing to withstand extreme corrosion, erosion and temperature, placed on test.

1939—15,000-LB. TEST VALVES
Highest pressure resistance ever obtained in lubricated plug valves, pioneered by Nordstrom, for 7500-lb. working pressure.

1940—1000° F. TEMPERATURE
Further development of Nordstrom Merchrome Coated Valves; for very high temperatures.



1941—EXTENDED VALVE LINE
Now offering more than 2000 types, sizes and modifications of Lubricated Plug Valves for almost every conceivable need.

Keep upkeep down with

NORDSTROM VALVES

MERCO NORDSTROM VALVE COMPANY – *A Subsidiary of Pittsburgh Equitable Meter Company*

WORLD'S LARGEST MANUFACTURERS OF LUBRICATED PLUG VALVES; GASOLINE, OIL & GREASE METERS

Main Offices: 400 Lexington Ave., Pittsburgh, Penna.

BRANCHES: New York City, Buffalo, Philadelphia, Columbia, Memphis, Chicago, Kansas City, Des Moines, Tulsa, Houston, Los Angeles, Oakland. *CANADIAN Licensees:* Peacock Bros., Ltd., Montreal. • *EUROPEAN Licensees:* Audley Engineering Co., Ltd., Newport, Shropshire, England

SOUTH AMERICAN Representative: The Armco International Corporation. *Main Office:* Middletown, Ohio

PRODUCTS: Nordstrom Lubricated Valves; Air, Curb and Meter Cocks • Nordstrom Valve Lubricants • EMCO Gas Meters • EMCO-McGaughy Integrators EMCO Regulators • Pittsburgh-National Meters for Gasoline, Grease, Oil, Water and other Liquids • Raybould Couplings • Stupakoff Bottom Hole Gauges

mercury in one chamber for a given differential pressure. A float in this chamber transmits this vertical rise through a linkage into angular movement of a pen on the chart. Thus, we can record accurately the true displacement on a clock driven chart. The manometer should be equipped with check valves to prevent sudden surges from blowing mercury; also there must be a pressure-tight stuffing box so that the pen motion can be transmitted without allowing leakage.

The static pressure recording mechanism, shown in Fig. VIII, is the standard pressure coil, usually of

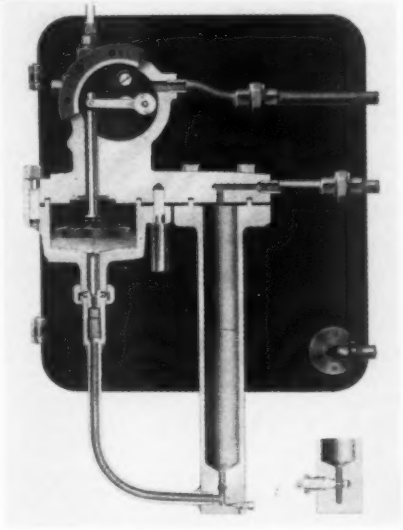


Figure VII. Differential manometer in orifice meter.

the helix type, arranged to record the static pressure on the chart using the same division lines as the differential pressure record. There are many refinements and features in the meters as provided by the various manufacturers, to insure accurate recording of these two functions.

Now that the physicist, the mathematician and the engineer have provided us with a measurement means by which to measure accurately large volumes of gas, we can turn the entire matter over to that group of men whose function is to maintain the meter in working condition and to translate the records made by the meter into totalized cubic feet. The maintenance of the meter is simply a question of checking the physical factors at stated intervals. The accuracy of the runs, the presence of straightening vanes, the sharpness of the orifice and other features should be watched and periodically checked. A schedule should be worked out for the testing of the differential recording mechanism for accuracy and also

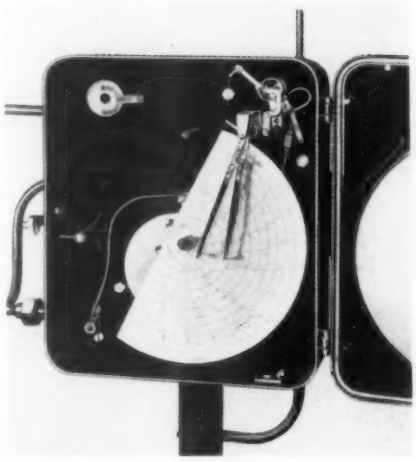


Figure VIII. Static pressure system in orifice meter.

for the static recording mechanism. The time clocks particularly should be watched to see that they maintain the exact angular motion of the chart in a given period of time and, of course, charts should be changed regularly at a definite time each day and careful records made of this time.

The translation of the static and differential pressure, as given on the chart, into cubic feet, is in itself quite a task. One method is to divide the entire chart up into hourly or quarter-hourly periods and average the static pressure and the differential pressure for each of these periods. These average values can be substituted in our formula $Q = C' \sqrt{h\ P}$ and knowing the coefficient of the plate, the total flow for that period is determined. Obviously, by adding the totals for each period the grand total for the chart can be obtained. This involves certain personal elements in the matter of averaging and since our formula is based on the square root of these functions rather than the first power, this averaging of the first power does not give us quite the true result. It is very probable, however, that unless the chart is too "wild" that satisfactory results are obtained this way.

Another method which is finding a wide application is the use of the chart integrator. In this device the operator places the chart on a motor driven plate. As this chart is turned the operator through the use of two handles causes two pens to trace over the differential and static pressure records on the chart. The machine automatically, from this positioning of the pens, computes the extension, that is, computes the value of $\sqrt{h\ P}$. Since this is a continuous process, absolutely correct values are obtained. The integration is instantaneous, that is, each instant of time is integrated properly and the question of averaging does not come up. This extension as obtained mechanically from the machine is then multiplied by the coefficient to determine the total delivery for the chart.

We now have our final measurement in the form on which billing can be based, that is, we can tell the total flow for any given period of time with a high degree of accuracy. To accomplish these results we have relied upon the four groups mentioned above, the physicist, the mathematician, the engineer, and the operator. Each one of these groups is extremely important and we believe that the accurate results obtained by the use of the orifice meter is one of the finest examples of cooperation within an industry.

Gas for Lake City Small Arms Plant

The Gas Service Company, Kansas City, Mo., recently signed a contract with the United States Government for supplying natural gas for the small arms manufacturing plant now being built by the government to be operated by the Remington Arms Company at Lake City, just east of Independence, Mo.

It will be necessary for the Gas Service Company to construct approximately nine miles of eight-inch gas main to supply the plant. A contract for the pipe line construction work will be made with a private contractor and work started as soon as possible. It is estimated it will take about sixty days to complete the entire construction of the line after the work is started.

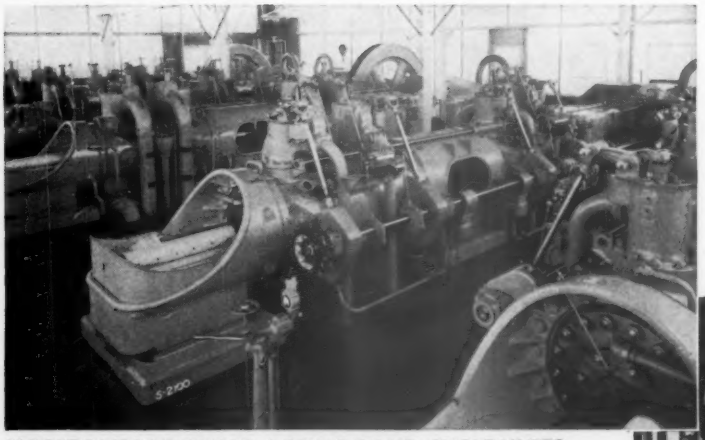
Gas will be used for all fuel purposes. Its principal use will be for heating and processing purposes.

Schmidt Speaks at Natural Gasoline Meet

Elmer F. Schmidt, vice president and operating manager of Lone Star Gas Company, delivered the keynote address at the 20th annual convention of the Natural Gasoline Association of America, held in the Baker Hotel, Dallas, April 23-25. Mr. Schmidt discussed "Natural Gasoline and National Defense." The meeting was held in Texas for the first time in the history of the association.

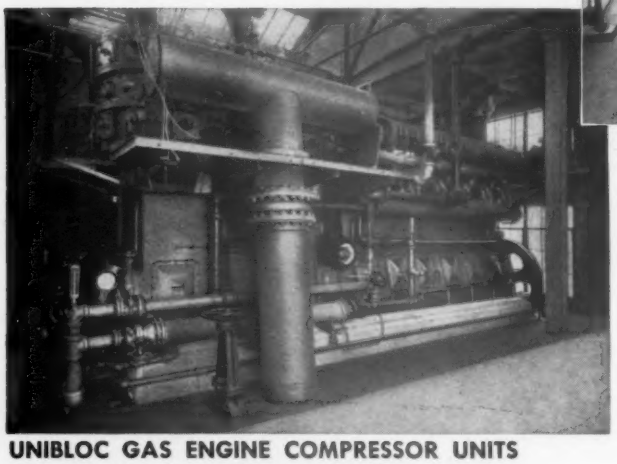
Lone Star men are active on the 1940-1941 committees of the association. They include: Mr. Jarvis, member of economics and research and educational committees; Percy Hall, gas contract committee; Roy C. Coffee, legal committee; Harry Wheeldon, vice chairman of the specifications and outage committee, and a member of the technical committee; and W. A. Rowsey, member of the traffic committee.

COMPLETE SERVICE for the NATURAL GAS INDUSTRY



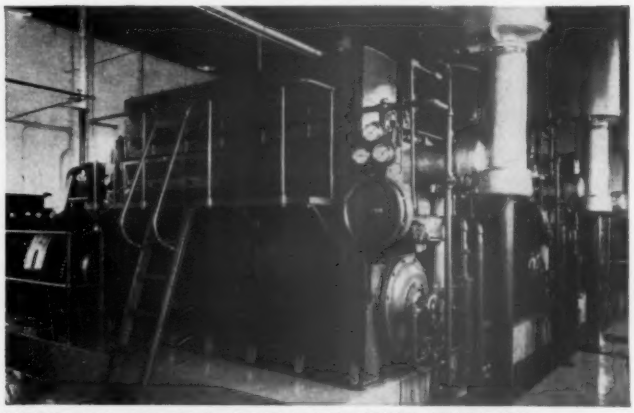
HORIZONTAL DOUBLE-ACTING FOUR-CYCLE UNITS for heavy duty main line service in the larger capacities.

(*At right*) **ANGLE UNITS** for main line, booster and distribution service in medium capacities.



UNIBLOC GAS ENGINE COMPRESSOR UNITS where space is limited. For gas distribution service.

MAIN LINE
•
BOOSTER
•
DISTRIBUTION
•
POWER GENERATION



VERTICAL CONVERTIBLE GAS-DIESEL ENGINES

THE installations shown here exemplify the complete coverage of Worthington compressor lines for every requirement of the natural gas industry.

For expanding the market for gas Worthington convertible engines are available up to 1500 horsepower. Their quick convertibility from gas to oil provides a definite investment protection to the engine user and constitutes a powerful influence in gas sales negotiations.

Nearly three quarters of a million horsepower in gas engines in operation

WORTHINGTON PUMP AND MACHINERY CORPORATION

General Offices: **HARRISON, NEW JERSEY** • *Offices and Representatives in Principal Cities*

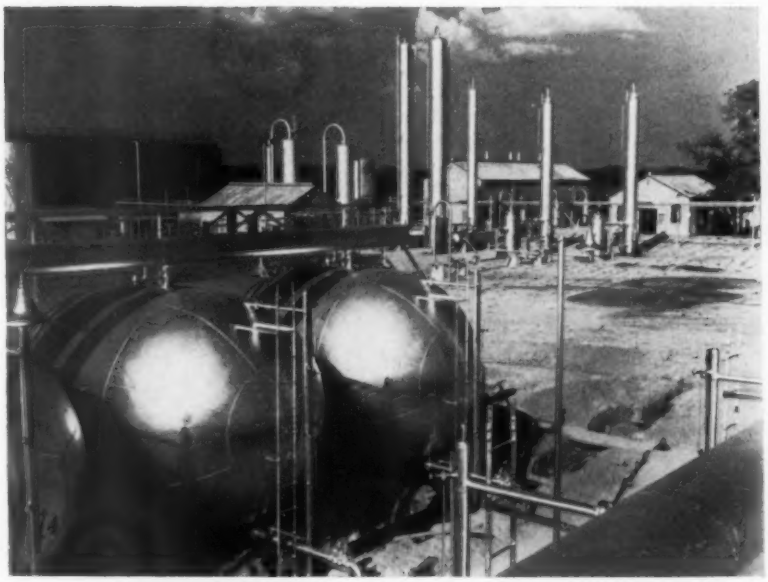
GC1-2

Industrial Development of Natural Gas In Texas

By
N. Van Deren

NATURAL GAS is meeting new industrial demands in line with the national defense program in Texas. Vital new building and training programs, linked with a policy of decentralization of industry, have brought to the state a tremendous upsurge of business. New factories are being built, factories already in operation are being enlarged, and camps are being prepared for hundreds of thousands of Army and Navy enlisted men—and the natural gas industry in Texas has ample facilities to fulfill these demands now and in the future.

According to figures released by the American Gas Association, industrial gas sales in Texas for the first eleven months of 1940 amounted to 116,618,288,000 cubic feet. As of December, 1940, Texas was producing approximately 4,596,014,000 cubic feet daily of natural gas from 4,027 dry gas wells and 49,722 casinghead wells, according to figures of the Texas Railroad Commission. There are 472 proven gas fields in Texas, and gas is distributed through 30,710 miles of pipe line.



The Lone Star Gas Company Recycling Plant near Grapeland, Texas, showing low-pressure storage tanks in the foreground.

Synthetic war products from natural gas, such as rubber tires, gun powder, chemicals and soap, are under contemplation or are being produced by the industry. Under pressure of war-time demands, the chemical treatment of natural gas could produce a variety of products ranging from dry ice to automobile tires, including some products which would be cut off from importation in the event of war. Dr. E. P. Schoch at the University of Texas has conducted elaborate investigations indicating it is economically possible to produce acetylene from natural gas. This valuable chemical is used in vital welding processes of airplane, tank, and mobile unit manufacture.

In the last World War, the Lone Star Gas System played an important part in the development of helium for lighter-than-air craft. Helium was extracted from natural gas which the company furnished to the government helium plants in Fort Worth and Petrolia, Texas. The largest helium plant in the world is now located at Amarillo, Texas.

Industrialization of the Southwest is indicated in the fact that during the past year more than 200 industrial and manufacturing plants have been established in the Texas and Oklahoma territory served by the Lone Star Gas System alone. Heading the list of these new industrial plants is the $7,000,000 North American Aircraft, Inc., factory under construction between Fort Worth and Dallas, but the hundreds of smaller factories — tire recapping plants, bakeries, and the ever-increasing number of Texas dairy plants—are also important to the national defense.

A tremendous stride in the utilization of industrial natural gas will be taken when the Madaras iron ore reduction plant now under construction near Longview, Texas, is completed. This process will utilize two native products of which Texas has ample supplies—iron ore and natural gas.

Since the beginning of the national defense program, the Lone Star Gas System companies have extended their facilities to serve several additional army camps and training centers. Natural gas is being utilized in various ways at most of the 159 improved airports in Texas—all of which have assumed a new importance in the present emergency.

Natural gas was first utilized in Texas about the beginning of the 20th century. Corsicana was the first town in the state to use natural gas, being served from a local field. In 1910 the Lone Star Gas Company completed the first long-distance pipe line in Texas, stretching 130 miles from the Petrolia Field in Clay County to Fort Worth, and then to Dallas. Despite the uncertainty of supply, during the next 15 years natural gas service was extended to scores of Texas towns and cities.

About 1925, following technical improvements in production and transportation methods and the opening of the Panhandle field, the industry entered an era of rapid expansion in Texas. In 1926, Community Natural Gas Company, a distributing unit of the Lone Star Gas System, launched its expansion program, and in four years constructed distribution systems in 200 Texas and southern Oklahoma towns.

Newest of the conservation processes being practiced by the petroleum industry in Texas is that of retrograde condensation—commonly known as recycling. This is a process whereby products are extracted from natural gas and the remaining gas returned to the production formation for future domestic and industrial

consumption. Among the products reclaimed from the natural gas are gasoline, kerosene, mineral seal oil, and butane. In December, 1939, 22 recycling plants reported daily recovery of 6,612 barrels from a volume of 470.4 million cubic feet, according to reports made to the Texas Railroad Commission. Among the products which are being produced from the distillate thus extracted from natural gas, is high-octane gasoline used in aviation.

Because of adequate and ever-increasing reserves and through thousands of miles of interconnected pipe line systems, the natural gas industry in Texas is well equipped to fulfill its double obligation in the wartime emergency—that of working at an all-out program in support of national defense while maintaining an efficient fuel service for thousands of homes.

How to Isolate Vibrating Machinery

By
W. F. Schaphorst, M.E.,
Newark, N. J.

These three sketches show clearly how to take care of machinery that is likely to vibrate and cause noise nuisance. One of the most effective modern methods, as indicated in the sketches, is to isolate shaky machines from the building or from the ground by means of a strong resilient material. Natural cork is generally regarded as best. Cork has a natural period of vibration which is invariably different from that of any machine, which fact is of great importance. Cork is almost perfectly elastic during a long period of years, which, too, is important. That is, cork does not gradually yield under pressure like most other materials. Cork does not rot, warp, swell, or shrink. From almost every viewpoint natural cork is an ideal material for machine isolation. Sometimes the cork is placed directly under the machine on top of the foundation, (see Fig. 1) and at other times the foundation itself rests on the cork, (see Fig. 2) depending upon conditions. Thus Fig. 1 shows how to isolate an electrically driven unit, the unit being completely tied to a concrete slab in such a way that vibrations cannot be transmitted to the building, and yet the machine cannot jump off of its base.

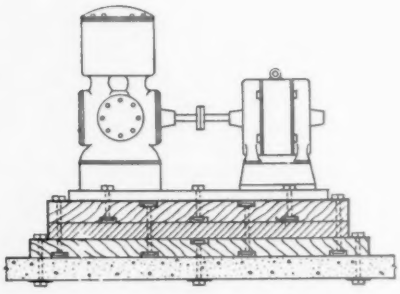


Figure 1

Fig. 2 shows how to isolate a machine without secondary tieing bolts such as are shown in Fig. 1. In other words, the concrete base is here placed in a pocket lined with cork. This is usually a very satisfactory method of isolation.

Fig. 3 shows in greater detail how the bolts may be isolated and applied. The "rubber hose kink", for further isolating long through bolts, is a good one to remember. An objection to rubber is that it soon loses its elasticity, but for this purpose of merely surrounding a bolt that fault is of but little importance.

Through tieing bolts are important. Thus I have before me an erroneous design, the error being in the elimination of tieing bolts from a top slab of concrete to the lower slab. In other words, there is nothing to prevent the machine from bouncing around and dragging the top slab and the machine itself around on the floor. The designer may argue, "This machine doesn't vibrate that much." To which a logical reply is: "If the machine doesn't vibrate that much it very likely doesn't need isolating. Why not be safe and use through bolts? They don't cost much more and are much to be preferred."

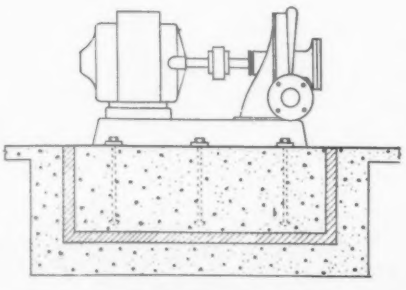


Figure 2

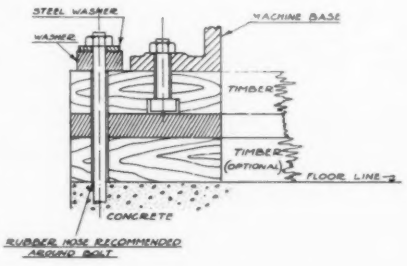


Figure 3

PERFORMANCE

. . . of benefit to all concerned

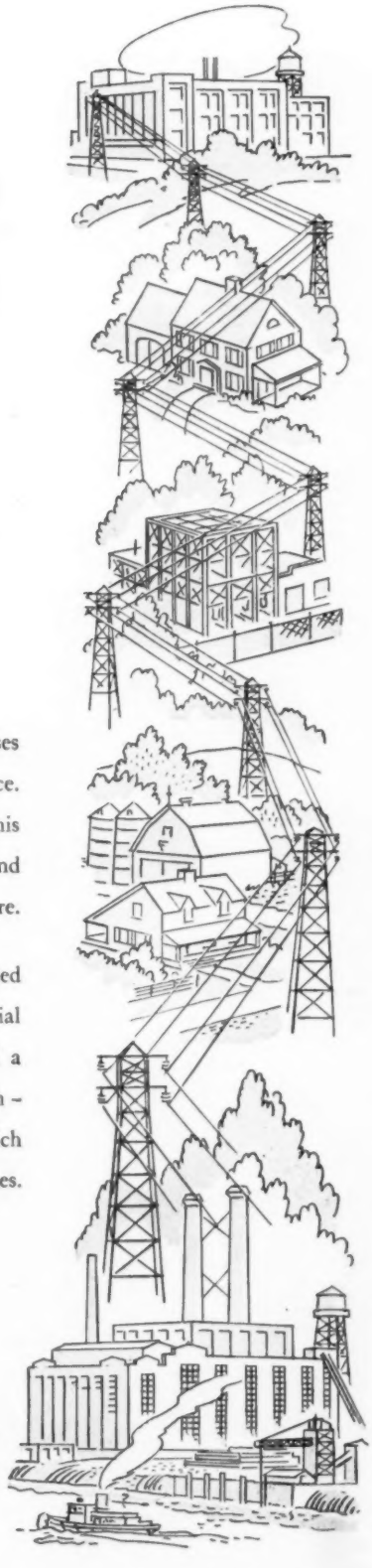
★

COLUMBIA SYSTEM and the widely diversified enterprises which it serves constitute a virtual business alliance. As supplied by the operating companies comprising this system, natural gas and electricity – for light, heat and power – are vital contributions to the public welfare.

In consequence, a community of interest has been created that extends beyond customers and employees. Essential service, cheaply and abundantly provided. has proved a stimulating factor in our economic and social growth – marking a dependable and efficient performance which is helping to fortify the nation in these trying times.

COLUMBIA SYSTEM

COLUMBIA GAS & ELECTRIC
CORPORATION

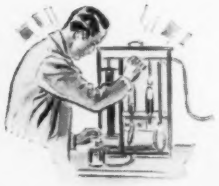


PERFORMANCE

IS ENGINEERED

..not an accidental result in a

UNIVERSAL GAS RANGE



● The future acceptance of gas as the ideal cooking fuel depends upon the standard of performance achieved in today's gas range. As pioneers in the betterment of gas cooking as a truly time-releasing service, Cribben & Sexton Company continually strives to anticipate public need and to pioneer convenience devices to meet it. Every worthwhile scientific improvement—every advanced device which will add to the convenience of gas cooking is built into the modern Universal.

How is this done?... Not by trial and error, a method which involves constant disappointments and costly set-backs in educating consumers to be *gas cooking* conscious . . . It is accomplished in the laboratory—*engineered* and not merely an *accidental result.* Every device undergoes exhaustive testing—its merits are thoroughly proved before it is finally accepted for use as part of the modern Universal Gas Range.

But, equally important, all of the research —the planning—the testing—done in the laboratories of Cribben & Sexton Company is done in anticipation of a definite need for constantly improving the service which gas renders to Mrs. Homemaker everywhere. Thus, Cribben & Sexton presents in the 1941 Line of Universal Gas Ranges an Automatic Controlled Cooking Performance that marks one more step toward the universal acceptance and recognition of gas as the ideal cooking fuel.

CRIBBEN & SEXTON COMPANY

700 NORTH SACRAMENTO BOULEVARD

CHICAGO ☆ ☆ ☆ ☆ ILLINOIS

Stopping Customer Traffic Through Appetizing Meat Odors

By
Arthur J. Larson

THOUSANDS of people come in every week to pay their gas bills at the Portland Gas & Coke Company, Portland, Oregon. On the sales floor of the company many appliance dealers have displays of ranges, water heaters and gas appliances. One of the big problems confronting salesmen was how to interest customers in the appliances on display when they hurried into the building to pay bills.

Many methods were tried to stop this customer traffic, and the most effective one, worked out by Chados Chase, sales floor supervisor, was to roast meat in some range on display on the sales floor. When the customers smelled the appetizing odor of meat they looked around and instantly asked where the meat was being cooked.

Then salesmen promptly led them to the range where the meat was being roasted in the oven and opened the oven and showed them how effectively a gas range did the job. As a traffic stopper this proved to be one of the most effective ones devised. It always worked and while people were looking at the meat the salesman could get in his sales talk about some new gas range.

It is estimated conservatively that sales of gas ranges from this method of stopping traffic increased sales about 25%.

But isn't it expensive to buy choice roasts every day, or roast chicken or turkey? is the natural question one thinks of. If an appliance store bought high priced roasts every day the cost on this method of advertising would soon prove to be too expensive for anyone to use much. What is done with the meat after it's roasted?

The meat costs nothing, and it is always used after being done. This is the way the plan works:

The word was passed around to employees of the company, and to appliance dealers and their employees that meat was needed for demonstration purposes in gas ranges. They were invited to take advantage of the demonstration by bringing in roasts, chickens, hams and have them cooked free.

In the salesroom, the appetizing odor of a roast drew customers to the demonstration.

It wasn't long before employees of the company and employees of the appliance dealers were bringing in meat which was cooked free, and after it was done, they got the meat back and took it to their homes ready to serve on their own tables after a brief reheating.

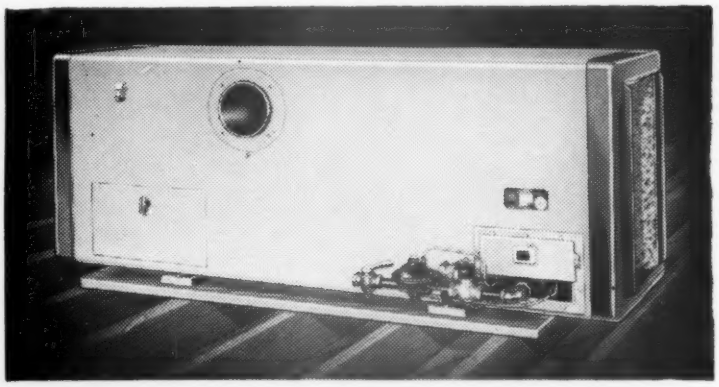
With the appetizing odor of roasted meat filling the sales room it was a common occurrence for some woman to say, "I smell meat roasting. Is there a restaurant around here?" Or some man usually would say, "My Gosh! That smells good! Where does that smell come from?"

A salesman close by would say, "Right over here in this gas range. Just step over and I'll show you."

The result of this demonstration as a sales promotion idea not only drew the questioner, but always drew several other people as well. So when the salesman opened the oven, he had a small audience who looked at the meat and heard his sales talk about the range's performance and the story of how gas did a good job.

The idea has proved to be so good that many a sale has been made from it. This idea overcame the problem of how to make customers stop and look at appliances when before it was used they hurried out after paying bills. Many times with a frown. Now after seeing and smelling the appetizing meat odor they leave with a smile and in many instances say, "I do need a new gas range, and I am interested in this one; it certainly does a good job of roasting meat."

Gas Boilers. Bulletin 331 B of National Radiator Co. gives specifications and fully illustrates their gas fired boilers for domestic, commercial and industrial use. 24 pages with comprehensive tabulation. Copy available from general offices at Johnstown, Pa., or any branch office.



LENNOX
STOWAWAY

Attic Gas Air-Conditioning Furnace

Opens New Market for Gas As Fuel

Complete Central Heating

FOR BASEMENTLESS HOMES

Replaces Troublesome Floor Furnaces

Forced Warm Air To Every Room

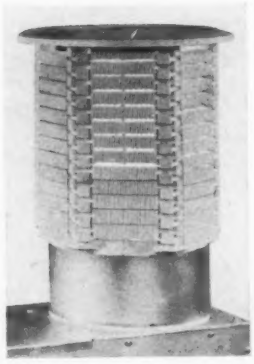
WRITE FOR COMPLETE CATALOG

LENNOX FURNACE COMPANY

Marshalltown, Ia. Syracuse, N. Y. Columbus, O.

HIGH AND LOW ENDS STOP AND GO

THE REPUBLIC
GRADIENT-HEET BURNER
PROVIDES
CONTINUOUS HEATING
WITH
THE GAS INPUT
AUTOMATICALLY GRADED
uP or DOwn
TO MATCH
THE OUTSIDE WEATHER



NOW— STANDARD EQUIPMENT ON EVERY REPUBLIC CONVERSION BURNER

AUTOGAS COMPANY
CHICAGO ILLINOIS

AIR HUMIDITY
Part 3*

By
O. J. Kuenhold
Humidification Engineer,
Monmouth Products Company

IN THE TWO preceding articles we have discussed what air humidity is, the various measurements of water vapor in air and the properties of air under various humidity conditions. We shall now consider the practical application of humidification and the safe high limits of humidity in homes. To obtain a proper understanding of these limits it is necessary to know what vapor pressure and dew point are and how they act.

Vapor Pressure

The atmosphere in which we live is made up of air plus water vapor. The atmospheric pressure, (barometric pressure) is made up of air pressure plus water vapor pressure. The vapor pressure is therefore a component part of the atmospheric pressure and is proportional to the density of the water vapor, or to the grains of water vapor per pound of air.

Table 1 shows the water vapor pressure at various air temperatures and per cents of saturation. The bottom line shows vapor pressure at average saturation of outdoor air. This is subject to very little variation at the lower temperatures. Referring to this table, we see that when air at 70° is 35% saturated with water vapor, the vapor pressure is .127 psi. (pounds per sq. inch). The water vapor will always diffuse from an area of higher vapor pressure into areas of lower vapor pressure. For instance, if the air in an adjoining 70° room is 30% saturated, Table 1 shows that the pressure of the water vapor in it will be .109 psi. The difference in vapor pressure (.018 psi.) is the driving force which causes the vapor to rapidly diffuse into the adjoining room through a doorway until both rooms have equal vapor pressure, though the temperature may be different.

The vapor diffusing force is effective in all directions causing the vapor to diffuse up or down open stairways, into ceilings, walls or floors, into woodwork, plaster, fabrics or other porous materials, if the vapor pressure in these is less than in the adjoining atmosphere. The vapor diffusion is always from the material or space having higher vapor pressure or density into materials or space having lower vapor pressure. (Osmosis and adsorption are disregarded in this discussion.)

Vapor will even be diffused through a porous wall if the vapor pressure on one side is less than the other side, but rate of flow through the porous wall will be considerably retarded by its density and thickness. For instance, referring to Table 1, we see that at 70° room temperature and 35% saturation the indoor vapor pressure will be .127 psi. while in 30° weather the outdoor vapor pressure will average close to .066 psi. The difference in vapor pressure will be .061 psi. (about 1 ounce per sq. inch). This is the force tending to cause water vapor to diffuse outwardly through the porous wall. Such diffusion through outside walls is one of two factors which may cause condensation of moisture within outside walls but which will be discussed further on.

If no moisture is added to indoor air there will be no increase of water vapor pressure, regardless of how much the air temperature may be increased. Increased temperature adds nothing to water vapor density and hence adds nothing to vapor pressure. The vapor pressure indoors will therefore be the same as the outdoor vapor pressure which, as shown by Table 1, is largely determined by existing outdoor temperature. But as soon as we add moisture to the indoor air, we add vapor pressure. For instance, Table 1 shows that in 40° weather, the vapor pressure, outdoors and indoors, will be .094 psi. Referring to the 70° column we see that at 25% saturation (relative humidity) the vapor is .091 psi., therefore during 40° the indoor saturation will generally be slightly above 25%. In 50° weather, the indoor and outdoor vapor pressure will average .128 psi. Note that at 60° room temperature this will result in 50% saturation; practically 35% saturation when room temperature is 70°, and 25% saturation when room temperature is 80°. It indicates that if 35% saturation is desired, no humidification is required in 50° or warmer weather.

Table 1

% Saturation	VAPOR PRESSURE IN POUNDS PER SQ. INCH AIR TEMPERATURE								
	0°	10°	20°	30°	40°	50°	60°	70°	80°
10%	.002	.003	.005	.008	.012	.018	.026	.036	.051
20%	.004	.006	.010	.016	.024	.036	.051	.073	.101
25%	...	...	...	...	...	...	.064	.091	.127
30%	.006	.009	.015	.024	.037	.053	.077	.109	.152
35%	...	...	...	...	...	...	.090	.127	.177
40%	.007	.012	.020	.032	.049	.071	.102	.145	.203
45%	...	...	...	...	...	...	.115	.163	.228
50%	.009	.015	.025	.040	.061	.089	.128	.181	.253
60%	.011	.018	.030	.049	.073	.107	.154	.218	.304
70%	.013	.022	.035	.057	.085	.125	.179	.254	.355
80%	.015	.025	.040	.065	.097	.142	.205	.290	.405
90%	.017	.028	.045	.073	.110	.160	.230	.327	.456
100%	.018	.031	.050	.081	.122	.178	.256	.363	.507
	.017	.027	.043	.066	.094	.128	Avge. Outdoor Vapor Pressure		

Humidity Limits

There is a limit to how high the humidity can be maintained in homes. The high limits are determined by the indoor vapor density at which condensation on windows and outside doors, and in outside walls occurs. These limits will now be considered.

Dew Point

When air is cooled, the maximum amount of water vapor it can hold becomes progressively less. The amount of water vapor originally held by the air will be an increasingly higher per cent of saturation as the air becomes cooler until a temperature is reached at which the air is more than 100% saturated. The surplus moisture will then condense. This is the dew point temperature.

For instance, air at 70° and 35% saturation holds 38.7 grains of moisture per pound. When the temperature is reduced to 41½° the 38.7 grains of moisture the air contains will saturate it to 100%. The 41½° is therefore the dew point tempera-

* *Parts 1 and 2 appear in February and March issues.*

ture of air containing 38.7 grains per pound or having .127 psi. vapor pressure.

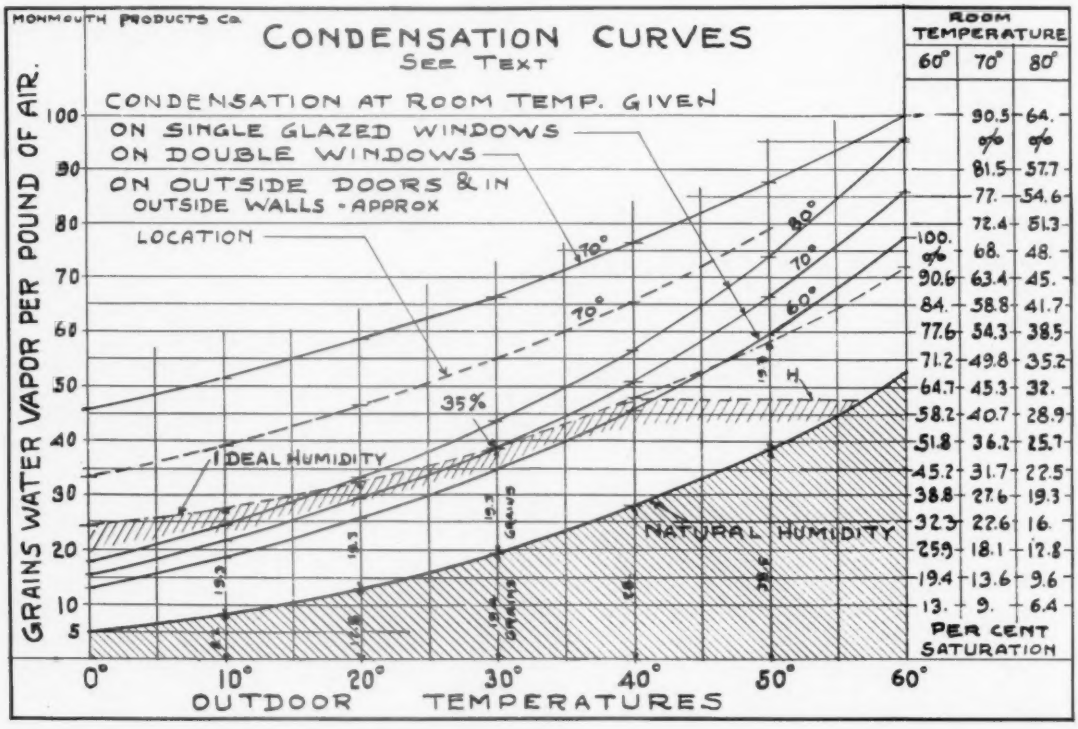
Window Condensation

When the air film lying next to the inner side of the window glass becomes cooled below its dew point, window condensation occurs. The temperature of the inner glass surface will be at some point between the room temperature and the outdoor temperature. When the room temperature is 70° it ranges from about 18° above outdoor temperature in zero weather to nothing above outdoor temperature in 70° weather.

In chart 2, the lowest curve, called "Natural Humidity," shows how many grains of water vapor is contained in the atmosphere per pound of air. The curves marked 60°, 70° and 80° show how many grains of water vapor must be present per pound of air for condensation to begin on single glazed windows when the room temperature is respectively 60°, 70° and 80°. This assumes the usually prevailing low wind velocity of winter. At higher wind velocities against or across the windows the window condensation begins at slightly lower indoor humidity but higher wind tends to increase air leakage and escape of added humidity.

The upper curve shows the room humidity at which condensation begins on windows to which a sealed storm sash has been added. The indoor humidity is given in terms of water vapor content in grains per pound of air, rather than in terms of relative humidity, because this reveals facts much more clearly. The measurements in vapor content of the air can however be translated into terms of per cent of saturation (relative humidity) by means of the scales at the right for respectively 60°, 70° and 80° room temperature. For instance, when indoor air contains 40 grains per pound this results in 51.8% saturation at 60°; 36.2% at 70° and 25.7% at 80° room temperature.

CHART 2



The second curve from the top shows approximately the point at which condensation occurs on wood doors exposed to 70° room temperature on the inner side and outdoor temperature on the outer side. The exact location of this curve depends upon door thickness, density of the wood, etc. The location shown is rather low.

The same curve also indicates approximately the humidity at which condensation in walls begins but this may be as much as 10 grains lower or higher according to wall construction, the influence of which will be further discussed presently.

No condensation can occur, anywhere in any weather, unless some moisture is added to the indoor air from some source. This holds true whether the home is heated or not. The vapor pressure and hence the moisture content of the air in grains per pound will be exactly the same indoors and outdoors and the dew point will always be above the temperature of any glass, metal or other surfaces of the house or in its walls, barring extremely rapid and extensive drop in outdoor temperature, which is rare, but can cause slight, temporary and inconsequential condensation.

When moisture is added to indoor air to cause progressive rise in vapor pressure and content in grains per pound of air, condensation will first appear on single glazed windows, then possibly on outside doors, then in outside walls and then on double windows. The point at which condensation occurs, that is, the vertical location of the wall condensation curve, in chart 2, depends upon the wall structure.

Wall Condensation

Condensation in outside walls involves indoor vapor pressure and the dew point. The difference between indoor and outdoor vapor pressure causes the water vapor to diffuse through porous outside walls or through porous sections of outside walls such as the lath, and plaster.

The higher the increase in indoor vapor density, the more rapid the rate of vapor diffusion through outside walls. The more dense the wall structure, the slower the rate of vapor diffusion. The vapor pressure or density cannot build up or increase in walls. On the contrary, the vapor pressure becomes less as it approaches the outer surface of a porous wall, in part diluted by the inward diffusion of air which always balances outward diffusion of vapor. The temperature of the wall however becomes lower toward the outer side just as the vapor density becomes less, but a point may exist where the temperature is lower than the dew point for the vapor density there existing, in which case condensation occurs. Note that for condensation to occur we must have a combination of low enough outdoor temperature and high enough indoor vapor density, plus certain factors of wall structure.

An ideal wall structure is dense at the inner side to retard vapor entry, and porous toward the outer side so that what little vapor can enter on the inner side can readily escape.

Next desirable is a wall which is sufficiently porous or leaky on the outer side to permit the vapor that passes through lath and plaster to readily escape, so as to dilute its density and therefore reduce its dew point toward the outer side.

Least desirable is a wall structure, porous on the inner side (lath and plaster) and dense on the outer side, such as sheet steel, water proofed stucco, tightly fitted wood sheathing painted on the outside with non-porous paint to form a substantially air tight non-porous vapor barrier. This invites condensation on and in the outer woodwork.

Heat insulating material placed in the studding space of frame houses reduces heat flow toward the outside, consequently reduces the temperature of the inner side of the outer sheathing which will then be below the dew point temperature when weather is cold and the indoor vapor density is raised very much.

Heat insulation is highly recommended in all homes to be constructed. Whether insulated or not, a vapor barrier *placed toward the inner side of outside walls* is also highly recommended for all homes to be constructed. It is inevitable that medical men will recommend higher air humidity in homes as they become better acquainetd with the great benefits to health which it brings and the ailments which it cures or aids to cure and this should be anticipated. For homes having wall construction which is undesirable from a standpoint of condensation, the inner portion of the outside walls may be vapor proofed by a coating of proper paint. An invisible coating, to close pores against passage of water vapor and which can be applied over wallpaper is possible and will no doubt soon be developed and placed upon the market. This will effectively aid in eliminating chances of wall condensation even with wall structure of dense exterior. Wallpaper which bars passage of vapor is feasible.

Humidity Control

There are three ways to automatically control room humidity: (1) to maintain the humidity static at some predetermined per cent; (2) to evaporate water into the air in proportion to how much heating is done; and (3) to have a constant increase of humidity over and above the natural humidity.

Static Relative Humidity: If we assume constant 70° room temperature, the 70° curve shows how high the vapor content of the air can be raised before condensation starts on single glazed windows. Suppose we assume relative humidity maintained at 40.7% or 45 grains per pound air. Follow the 45 grain horizontal line across and note how far above the 70° window condensation curve the humidity will rise. If room temperature should rise above 70° for instance to 80°, the relative humidity will still be maintained at 40.7% but for 80° this will raise the vapor content to almost the 65 grain line (as the chart shows) and this will be far above the window condensation line for 80°. Obviously this method of control promotes condensation and is incorrect.

Evaporation Proportional to Furnace Heat: If we assume the evaporator of adequate size to be able to raise the humidity to the window vapor point in average winter weather (30°) then, instead of reducing the maintained humidity as weather becomes colder, the evaporation will increase as more heat is required and delivered, resulting in higher, instead of lower humidity, thus increasing instead of decreasing the humidity and therefore increasing window and wall condensation.

Constant Humidity Increase: In this system of automatic control, we evaporate a fixed predetermined amount of water into the air, regardless of outdoor temperature variations. The amount of water evaporated is set at such a rate that the water vapor contents of the indoor air will be increased and maintained at about 19.3 grains per pound of air above the natural humidity, which prevails when no humidifying is done. The maintained humidity will then always be 19.3 grains per pound above the natural humidity in any weather. Note how the natural humidity becomes lower as weather becomes colder. Also note how the ideal humidity also becomes lower as weather becomes colder, paralleling the natural humidity curve.

Now compare the ideal humidity curve with the window vapor curves. Note that, in average winter weather (30°) and 70° room temperature, single glazed windows will show traces of vapor. As weather becomes colder the vapor increases but not seriously. As weather gets below 20° the window condensation is frost and therefore does not run down the windows. The resultant vapor density remains safely below the condensation curve given for outside doors and no wall condensation will occur even if the wall structure is such that the wall condensation curve is 10 grains (or two lines) lower than the curve shown. No wall condensation has ever been reported to the author in any cases where the humidity has been graduated in accordance with the ideal humidity curve shown in Chart 2, although calculation shows that in cases where the wall structure has a vapor barrier near the outer side and a porous interior wall structure, condensation can occur during continued zero or near zero weather.

Note that in zero weather, which is usually of short duration, the "ideal humidity" is practically 5 times as high as it would be if no humidifying was done, while in average winter weather (30°), which prevails most of the time, the maintained humidity (35% in 70° room temperature) is twice as high as it normally would be. As has been explained in a preceding article, the air has the same moisture avidity at 70° room temperature as is usual for summer outdoor air.

As there is a constant increase of about 19 grains of water vapor per pound of air, there is also a constant increase in vapor pressure of only about .062 psi. (one ounce per sq. in.) above whatever outdoor vapor pressure may exist. At this low pressure difference so little vapor is diffused through and against the resistance of the lath and plaster that the little vapor that can get through is readily diffused through the outer wall surface unless this is exceptionally dense and tight.

"I WOULDN'T LIVE IN A HOUSE WITHOUT Gas!"

Gas is a part of modern living. Nearly everyone accepts it as the ideal fuel. But how quickly a few pilot outages, a few appliances that refuse to work, can undo the goodwill which years of good service has built up. Obviously, this goodwill can be maintained only through delivery of CLEAN, DRY, CONDITIONED GAS such as is assured by...

NEW LOW-COST BLAW-KNOX "K" SERIES GAS CLEANERS

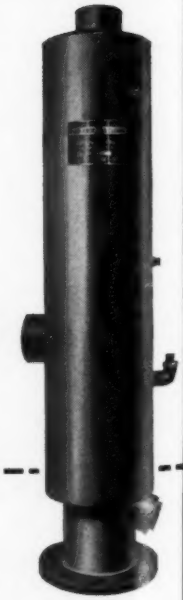
... your best possible protection against dust, rust, scale and liquid condensates.

Available from stock in 2 sizes and 3 weights, the K series are compact, inexpensive, easy to install. They are useful in many ways, especially for the final conditioning of gas near point of use, as in front of a good customer's meter, or at district regulator stations, small city gas stations. Other uses are suggested in the coupon.

The K-L6 will thoroughly condition 396 MCF per day, flowing at 30# gage pressure. And the price is...

Only $95

MAIL THE COUPON and we'll send you complete details regarding type of unit you need, cost and method of installation.



CLEAN GAS MAKES SATISFIED CUSTOMERS

BLAW-KNOX
GAS CLEANERS

BLAW-KNOX DIVISION of Blaw-Knox Co.
Farmers Bank Building Pittsburgh, Pa.

BLAW-KNOX, Pittsburgh, Pa.

Gentlemen:

Without obligation I would like to have more information on your "K" series Gas Conditioning Equipment. My conditions are as follows:

☐ District Regulating Station	Max. Gas Volume MCF hour_____	Min. Pressure_____	Max. Pressure_____
☐ Small City Gate Station	Max. Gas Volume MCF hour_____	Min. Pressure_____	Max. Pressure_____
☐ Town Border Station	Max. Gas Volume MCF hour_____	Min. Pressure_____	Max. Pressure_____
☐ Industrial Take-off	Max. Gas Volume MCF hour_____	Min. Pressure_____	Max. Pressure_____

Principal material to be removed ... Dust ☐ Rust ☐ Sand ☐ Scale ☐ Liquid Condensate ☐

Name_____ Title_____

Company_____

Address_____

Insurance for Gas Companies

By
Clarence T. Hubbard
Secretary, Automobile Insurance Co., of Hartford

IT IS NOT necessary for a gas company to purchase every form of available insurance, but rather, to apply the proper coverages to the individual financial exposures of each company to the hazards outstanding which can in any way effect its assets or expense ratio.

First, an understanding of what your insurance needs are is most important. There are at least 200 different forms of insurance which a gas company could purchase. If money were no object, the simplest way would be to buy every one of these insurance policies. Then you would be completely insured.

But, insurance costs are carefully analyzed today, and every gas company wants to eliminate any superfluous insurance coverages. In the effort to accomplish this, there has come into the fabric of things, the appointment of full-time insurance managers and for firms which cannot afford to engage a full-time insurance manager, taking recourse to the services of a professional insurance counsellor who serves a number of different accounts. As a company representative, the only criticism we have of the two foregoing methods is that sometimes the manager or counsellor is forced to depend entirely on the economies he can produce for his personal income, and therefore, is tempted in his zeal to save, by sometimes trimming the protective features of some insurance contracts and to favor low-cost insurance without due regard to other important factors, namely, the stability and management of the insurance carrier selected or the adequacy of coverage to the policyholder. Furthermore, the professional managers and counsellors, in their influence, introduce inconsistency in management philosophy by themselves representing declared profit motive organizations, but encouraging insurance offers from other than capital stock insurance carriers.

The more generally adopted method of the day for obtaining the most effective insurance protection is through the insurance survey, prepared by carefully selected agents or brokers. It is obvious to me, from a country wide observation, that the only way a gas company can be survey insured, is to:

(a) Centralize your insurance responsibility for analysis and supervision in one common source (even if individual policies have to be distributed among several agents and brokers).

(b) Review all insurance contracts, financial and credit problems, and safety measures at definitely stated periods with your chosen insurance representative.

Now the choosing of this particular representative is a serious responsibility on the part of someone in your gas company. Consider that there have been between 5,000 and 10,000 students graduated by the various capital stock fire, casualty and life insurance companies in the last five years. These students, young and old, have come to the home offices of the various capital stock insurance companies, where training divisions are maintained. Educational classes are conducted as efficiently and with the same concentration and teaching facilities as offered in any modern university. Only those with stamina, ambition and intelligence, can earn their diploma, as these courses require study until 2 o'clock in the morning as an average, plus all day lectures and the practical demonstration of solving insurance problems. Those who pass their examinations are accepted by some state insurance departments as qualified for a license in lieu of an examination by the department itself.

Many experienced agents and brokers and agency employees attend these schools, as well as young men who are entering the insurance business. In addition, nearly all of the capital stock fire and casualty and life insurance companies conduct excellent correspondence courses. Several of our university facilities offer extension courses in insurance and, in our larger cities, there are independently incorporated colleges of insurance. There is one in Hartford where 60 people are presently enrolled. Then there are chapters of the American Institute of Insurance which conduct after-hour insurance training courses.

Any agent or broker whom you select should be a person of training. Many agents and brokers are naturally self-trained by long experience and a studious tendency, but it is most important that you should first determine what educational activities your insurance agent, broker or counsellor has undertaken. Insurance has become very complex in its technicalities, by reason of changing conditions, innumerable laws and the peculiar experiences of the business itself. Therefore, every gas company, in placing and maintaining its insurance program, should first make absolutely certain that its selected insurance representative "knows his stuff."

Assuming that you approve of the insurance survey or risk analysis now commonly used, your carefully selected insurance representative will review all of your present insurance policies to determine whether you are over-insured, under-insured, adequately insured, and whether your insurance fits the peculiar needs of your business. If he is the type of agent or broker described, he will make no attempt to capitalize on this privilege by selling you insurance. Instead, he will apply insurance to your needs in the most scientific manner possible. He will inventory your policies by premium, liability and expiration, and while you may not be able to place every insurance policy with him, he should be, nevertheless, required to inspect and review every policy you purchase. While he will furnish you with a complete insurance survey and recommendations in bookbinder form, with your expirations all tabbed by months, the most efficient results are obtained by having stated periodic interviews so that you may be sure that you are obtaining the benefit of all of the latest and many changes in policy forms, methods and rates and that he, your insurance representative, may be aware of your complete needs, not only in the way of insurance, but in engineering service.

Now as to the individual forms of coverage which a gas company should carry. As already emphasized, there is no blanket program, as each risk must vary. However, the financial worry each of you should eliminate is in the way of all *total loss possibilities.* I refer to perils which could and have in their

---

Presented before the Annual Business Conference of The New England Gas Association, Boston, Mass., March 27, 1941.

occurrences, completely absorbed the assets of a corporation when not properly insured, namely, fires, explosions, earthquakes, hurricanes, liability suits, prolonged interruptions to earnings. I just naturally assume that gas companies are fully insured against loss by fire and explosion, these two perils usually being insured against under the fire contract. But insurance surveys reveal astounding discoveries as to the fulfillment of co-insurance requirements, the values insured, the rates and forms. The peril of hurricane, for many years ridiculed in this section of the country, is now taken seriously. Interest in earthquake insurance has been accelerated by New England tremors and much publicity regarding the major faults lying in New England, and that part of this very city of Boston is on filled ground. I would consider earthquake a total loss possibility in relation to your gas holders and plant and equipment. Some gas companies insure their mains and distributing systems against loss from earthquake shock—the latter I would not consider a total loss possibility. A steam boiler explosion could be a total loss and should be fully insured against. Any contingency which could lead to an unfavorable court judgment, should be fully insured against. An embezzlement that could threaten your assets should be fully insured against. Any prolonged interruption to your earnings is a total loss possibility. I am not prepared to say whether vandalism, malicious mischief or sabotage could totally destroy your property, but, under present day conditions, I would consider it a "must" coverage. Riot insurance might also be so considered.

Therefore, first, if I were a gas company executive, I would make absolutely certain that all total major loss possibilities were insured, and therefore, I would carry full insurance to value against loss by fire, explosion, hurricane, steam boiler, sabotage, check forgery, embezzlement and exposure to claims and suits for personal liability.

Furthermore, not enough property owners consider the fact in purchasing hurricane, riot, explosion, earthquake and similar so-called allied fire insurance policies, that the ordinary fire insurance policy in many states contains a Fallen Building Clause wherein if a building or material part collapses, the straight fire policy is automatically voided, but if you carry hurricane, riot and earthquake policies, or various endorsements which combine these hazards, you obtain fire insurance protection under such policies, as well as the damage from the perils named. This is called "bridging the gap" and really succeeds in perpetuating your fire insurance.

War risk insurance is available, but only for a short term. That is, most companies will issue such a policy for not longer than one year and with a non-cancellable clause usually not exceeding three months, so that you are only purchasing a short term coverage which, if invasion occurred, or war were declared, might not be renewed.

Bear in mind on sabotage insurance, that it is issued under two forms—a limited form and a broad form. The broad form includes sabotage caused by secret enemy agents even in times of peace.

A form of insurance more popular in the West than the East for gas companies, is explosion and fire legal liability insurance. This protects a gas company from claims brought by property owners for fire and explosion losses. The rates are predicted usually on the number of meters and the limit of liability desired and whether the policy is to contain any deductible features or not. If any of you would like a questionnaire on which such rates are based, I should be glad to supply them to you through Mr. Clark Belden without your revealing your identity, as this is meant constructively and not for any prospective sales opportunities.

In the way of casualty insurance, within the past year, the insurance companies have brought out "comprehensive forms" which make it possible to insure many hazards under a single policy and for less cost than would be paid for insuring each single hazard separately, so to speak, and also with the benefit of broader protection.

The new comprehensive liability policy is important to gas companies for, as stated earlier in the article, I consider the exposure to possible liability claims to come under the classification of "total loss possibilities." Today you can insure against claims brought by the public for bodily injuries and property damage under one single comprehensive liability policy. Such an insurance contract may be issued to insure claims developing from accidents which occur on owned or leased premises, accidents from elevators, accidents resulting from general business operations, accidents arising from the use of products manufactured or sold and accidents caused by teams. Furthermore, such a comprehensive policy may include "liability of others" assumed by a gas company under a railroad side-track agreement or a lease or some other contract. Of course, this must be specified in the policy. If a hospital or clinic is maintained, which treats members of the public, the professional liability hazard, its incident thereto, may be insured under the comprehensive liability policy. It will also include liability of a gas company for accidents caused by independent contractors or their employees. And in all but a very few states, the comprehensive policy includes coverage for accidents involving owned, non-owned and hired automobiles and trailers.

This new insurance policy is one which gas company executives should most surely go over with a chosen competent insurance representative. The contract, as you can see, can be tailored to fit the peculiar requirements of each enterprise. Furthermore, it contains an automatic coverage provision under which the gas company is protected for public liability exposures which were not known to exist when the policy was issued, as well as for additional liability exposures which create themselves at any time during the term of the insurance.

The public liability insurance for gas companies is frequently written on an excess basis, which means that the gas company assumes all losses up to a certain amount agreed upon per accident. Sometimes a gas company will insure certain public liability hazards on a full coverage basis, such as automobile insurance and premise accidents, but explosions on an excess coverage basis.

Another comprehensive policy has made its appearance in the field of so called "criminal loss" coverages. It combines eight policies in one single contract. In other words, it rolls into one, the protection against loss thorough dishonesty of employees, previously insured in a separate primary blanket bond; (2) loss in the way of destruction to securities within the assured's premises, previously written in a separate premise all-risk policy; (3) the loss of money, securities, or other valuable property caused by forcible entries to safes, previously insured in a separate mercantile safe burglary policy; (4) the destruction of money or securities on the premises from any cause except larceny, theft or disappearance; (5) loss of payroll or other moneys caused by holdup, formerly insured in a separate policy known as messenger and interior robbery; (6) loss of money and securities while in the custody of

messengers away from the premises; (7) loss of securities from a bank safe deposit box, caused by burglary, robbery or other hazards; (8) loss against forgery or alteration of any outgoing check, draft, promissory note or similar papers.

This described policy would give a gas company all the needed "criminal loss" coverage with one exception, and that is if you maintain retail stores for the sale of gas appliances, then you need a separate mercantile open stock burglary policy.

Another comprehensive policy is the accounts receivable contract which insures any loss sustained by your inability to collect money from customers due to the destruction or damage of your accounts receivable records.

Your automobile hazards cannot be included in the previous comprehensive policies, but can be covered under a separate automobile schedule liability contract which would insure a gas company's liability for bodily injuries or property damage caused by owned or hired automobiles or trailers or accidents developing through the use of vehicles not owned or hired, but which are used in the conduct of your business, such as pressing an employee into some errand or service. Then you also need an automobile material damage policy which provides for insurance to all owned automotive equipment caused by fire, theft, windstorm, explosion, water, flood, riot, glass breakage and other hazards, collision insurance being optional.

Of course, compensation insurance or employers liability insurance is a "must" coverage which is familiar to you and you should check carefully with your insurance representative the rating privileges under such present day policies.

There are many other miscellaneous forms of insurance such as plate glass and sprinkler leakage and water damage. Beyond this, for instance, if your company rents space to others, you might want to know about water damage legal liability insurance as well as sprinkler leakage legal liability insurance.

Some gas companies carry aircraft and motor vehicle property damage insurance especially when located near flying fields. This can be purchased as a separate contract or sometimes endorsed on an ordinary fire insurance policy and bear in mind that such a contract again assumes the fire damage following such a crash if the fire policy has been voided.

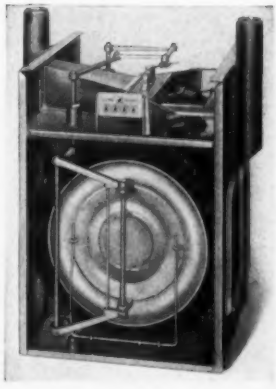
There are also the various social forms of insurance growing in popularity, namely, group life insurance, group accident, group hospitalization, and group annuity coverages. The ramifications of these group forms of protection are more than any one agent or broker can be expected to know.

Corporation life and accident insurance should all be gone over in insurance survey and risk analysis, whether such insurance is purchased or not.

I have touched upon the major coverages, although there are many more which could be discussed and probably to advantage. There is rents insurance, various builder's risk coverages, all types of all-risk floaters to cover products and equipment in transit and at temporary locations, various consequential damage forms of insurance, contract and other bonds not mentioned in the previously described coverages, but which are essential for certain operations, extra expense insurance, neon sign insurance, registered mail and parcel post insurance, salesmen's sample floaters, and even insurance which insures insurance premiums, namely unearned premium insurance.

SUPERIOR GAS METERS

The new, improved Superior "C" is designed especially for those increasing industrial loads. It embodies a simplicity and ruggedness of construction, featuring fewer moving parts, heavier flags, quiet-acting valves, and a high ratio of capacity to space occupied. "C" Meters are made in five sizes from 600 cu. ft. per hour to 7,500 cu.ft. per hour.



For domestic and commercial use, Superior offers a choice of eleven "A" and "B" type meters ranging from 150 to 3,400 cu. ft. per hour.

Wet Test, Station and Demonstration Meters—Diaphragms —Service Cleaners—Provers—Complete Meter Repair Facilities.

Our bulletin, #23, gives full facts about SUPERIOR Meters and shows why we enjoy an increasing volume of repeat orders from most of the large utilities. Write for it.

SUPERIOR METER COMPANY, INC.

167 41st Street *Brooklyn, N. Y.*

Useful Products from Natural Gas

(Continued from page 18)

Plaskon molding material is an improvement on the dark browns and black compounds available for many years. By the use of water white urea formaldehyde resin, a colorless plastic molding compound is produced and by proper pigmentation this can be converted into any color from pure white to varying shades entirely lightfast. This compound being available in many colors together with its exceptional electrical properties combines to open new fields of application for which thermo-setting plastics had been heretofore unsatisisfactory. Plaskon may be used in many ways chief of which are its application for lighting fixtures, buttons, housings, display containers, tableware, and closures.

The most widely used resins are the phenolics. Typical examples of these resins are Bakelite, Opalon, and Resinox Phenolic compounds. On the basis of tonnage produced these phenolics have always been the most important synthetic resins. These resins may be produced by the reaction of phenols with an aldehyde, such as formaldehyde, in the presence of a catalyst. At the present time only a small amount of phenols are used in the synthesis of resins for protective coatings. Yet it is interesting to note that the side chains of these phenols are obtained with such raw materials as isobutylene and trimethyl-ethylene from refinery and natural gases. Uses of these resins include high and low frequency radio insulating parts, clock crystals, aircraft instrument panels, dishes and many other applications such as engineering applications in the field of binding agents and cement.

Development in the plastic industry is continuous and of the newcomers, vinylidene chloride and melamine resins are outstanding. Vinylidene chloride has recently been announced by Dow Chemical Company and in addition to possessing many desirable features of the plastic group, it has an extremely high tensile strength. This product is being successfully used in women's wear items such as felt hats and dress trimmings. It has also been suggested as a substitute for natural rattan. Its use as lines in commercial and sport fishing has been most satisfactory. American Cyanamid has developed melamine resins which are made by reacting melamine with formaldehyde. These resins replace urea resins where better molding properties and water resistance are required.

Many useful products which may be manufactured with natural gas as a raw material have not been mentioned in this paper. The many possible products as given, however, indicates the tremendous potentialities of natural gas as a raw material. The best insurance to recover these important raw materials and make them available to industry is active research.

In response to the vital and immediate need for fundamental research felt by the gas industry of the United States a special committee of the American Gas Association, under the leadership of Mr. Frank C. Smith of Houston, Texas, formed about two years ago, conducted a study and made a report to the Association on the subject, recommending the establishment of a research institute by the industry. The same committee, upon the discharge of its duties, constituted itself a group which continued its studies of the means by which research could best be accomplished in behalf of the gas industry and, after a great deal of study and investigation, drafted a plan for the establishment of an institution to be called the "Institute of Gas Technology." This plan is now under consideration by member companies of the gas industry and may become realized within the present year. It is significant to note that the organization finds throughout the gas industry a general realization of the need for research, both fundamental and applied, and has received encouragement and pledges of support from substantial elements of the gas industry.

The many useful products some of which were discussed in this paper may play an important role in the future development of our country. They may be used in the construction of equipment for the armed forces of our country and they may be used in consumer products to replace strategic metals necessary in other fields. The amount of these essential raw materials supplied by the natural gasoline and natural gas industries will depend upon the ability of these groups to recover and supply these raw materials and to maintain and actively support research work to insure the use of natural gas for useful products of today and tomorrow.

REFERENCES

(1) Sidler, Paul—The Combustion Gas Turbine, Gas, March, 1941.
(2) Smith, Harold M.—Utilization of Natural Gas for Chemical Products, Bureau of Mines Information Circular 1708, April, 1940.
(3) Gabriel, C. L.—Nitroparaffins and their Derivatives, Chemical Industries, December, 1939.
(4) Segeler, C. George—Versatile Gas, Chemical and Fuel, American Gas Association, Industrial Service Letter no. 31.
(5) Clark, Melvin E.—Neohexane for 100-Octane Plus, Chemical and Metallurgical Engineering, April, 1940.
(6) Synthetic Organic Chemicals, Chemical and Metallurgical Engineering, Page 103, February 1941.
(7) North, Dexter—"Rubber" from Petroleum Gases, Chemical and Metallurgical Engineering, April, 1940.
(8) Wakeman, Reginald L.—Plastics and the Gas Industry, Proceedings of the American Gas Association, 1940.
(9) Weidlein, E. R.—The Aid of Research to Industry, Proceedings of the American Gas Association, 1938.

The Gas Machinery Co.

Complete Gas Plants

Cleveland, Ohio

CRUSE-KEMPER COMPANY

STEEL PLATE CONSTRUCTION

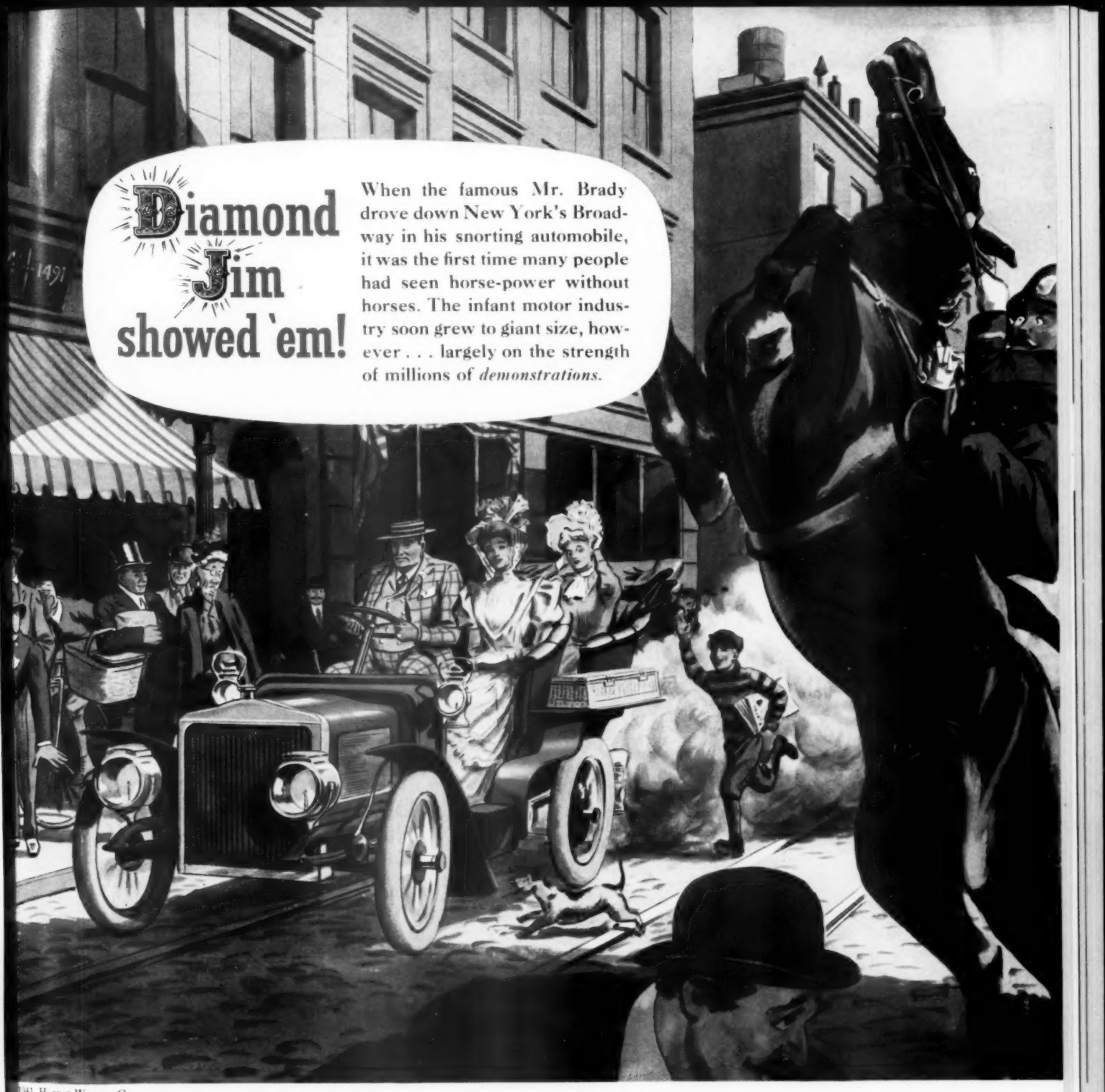
AMBLER, PA.

GAS HOLDERS

HOLDER INSPECTION

RIVETED OR WELDED FABRICATION & ERECTION

TANKS, BINS, FLUES PURIFIERS, WELDINGS


Diamond Jim showed 'em!
When the famous Mr. Brady drove down New York's Broadway in his snorting automobile, it was the first time many people had seen horse-power without horses. The infant motor industry soon grew to giant size, however . . . largely on the strength of millions of *demonstrations.*

1941, Harper-Wyman Co.

Nothing convinces like demonstration

TODAY the gas industry has a vitally important job to do. It must show the public—continuously—that "Gas does it best."

Nothing does this more effectively than a demonstration of the Harper Burner System. Actual demonstration gives life and meaning to the Harper principle of "2 burners in 1", both controlled by the same handle. It shows modern cooking at peak efficiency . . . proves the time-saving speed of the STARTING BURNER . . . the exactly measured boiling heat of the tiny, economical COOKING BURNER . . . the system's quick, accurate control of *every* cooking heat.

Once your customers see the Harper Burner System *in action* they are "sold" on the performance and economy of the modern gas range . . . the unequalled efficiency of gas as a fuel.

DEMONSTRATES THAT "GAS DOES IT BEST"

HARPER
BURNER SYSTEM

TURN THIS PAGE FOR PROOF THAT DEMONSTRATION PAYS...

This simple Demonstration will help you sell more Ranges

You will agree that live displays attract customers' interest. We therefore suggest this. Keep about eight quarts of water boiling on your Harper-equipped demonstration range. Use a covered glass vessel and put in several strips of fast-color fabric to emphasize the boiling. *Be sure to use the Harper* COOKING BURNER. A sign, "See the tiny flame which keeps water boiling without waste of fuel," helps to draw attention.

Once your customers *see* the small, accurately gauged flame which performs the work for which they have been using *three to four times as much gas*, they will readily understand how the Harper Burner System saves up to 39% on gas.

This simple demonstration does more than prove an important point. It also awakens curiosity . . . opens the way for your entire sales story . . .

FREE BOOKLET: "How to sell More Gas Ranges," contains a series of quick, convincing sales acts planned to dramatize the advantages of the modern gas range. Send for copies. *Harper-Wyman Company, 8562 Vincennes Ave., Chicago, Illinois.*

The Harper Burner System operates on the unique principle of "2 burners in 1" . . . a* STARTING BURNER *plus a small, economical* COOKING BURNER, *both controlled by the same handle. It is subject to finer gradations of low heats—greater control and economy—than any other cooking unit made.

THE PHILADELPHIA GAS WORKS COMPANY
1401 ARCH STREET
PHILADELPHIA

Harper-Wyman Company,
8562 Vincennes Ave.,
Chicago, Illinois.

December 2, 1940.

Gentlemen:

For the past six years we have pushed gas ranges equipped with your top-burner system. In fact, we require manufacturers to supply us with ranges equipped with simmering top-burners, meeting the requirements of (a) simmering position to operate on an input not to exceed 1600 b.t.u.s with automatic top ignition or re-ignition at this point, (b) simmer feature to operate independent of the main burner.

The cooking results obtained from such burner operation are susceptible to dramatic interpretation to the housewife, and our salesforce are urged to demonstrate on connected gas ranges wherever possible.

Such cooking results keep gas in the forefront as the modern, dependable, and economical fuel for cooking. Your burners fully meet our simmer burner requirements, and we are grateful for such contributions to the continued paramount performance of gas as a fuel.

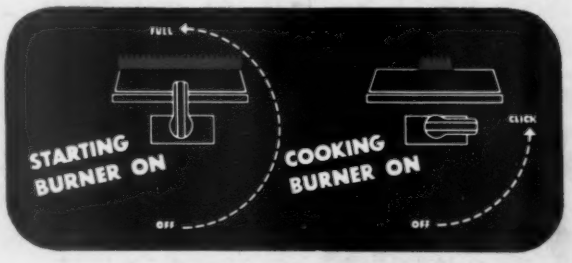
Yours very truly,
THE PHILADELPHIA GAS WORKS COMPANY

GWSig

Geo. W. Schoch
General Supervisor, Domestic Appliance Sales

LET *Gas* DO THE 4 BIG JOBS—Cooking · Refrigeration · Water Heating · House Heating

Proof That Demonstration Pays



HARPER BURNER SYSTEM

—one of the standards of top burner performance under Gp

Validity of City and State Gas Regulations

By
Leo T. Parker
Attorney at Law
Cincinnati, O.

SEVERAL higher courts have during the past few months rendered important decisions involving state and city gas company regulations. Many of these laws have been held void, or ineffective. Therefore, in order that readers may have opportunity to absorb the new law on this subject, we shall review these new cases.

First, it is important to know that all laws regulating a gas company are void which are unreasonable, discriminatory or arbitrary. This is settled law. The limitation on the legislative discretion is that the regulations must be reasonable, not arbitrary, and must rest upon some ground having a fair and substantial relation to the object of the legislation, so that all gas companies and gas consumers, under similar circumstances, shall be treated alike. Therefore, the power of the Legislature in this matter is very broad and comprehensive, subject only to the limitation that it must appear to have been made upon some "reasonable ground." In other words, something that bears a just and proper relation to the attempted classification or regulation and not a mere arbitrary selection must be shown.

When Service Is Legally Abandoned

Considerable controversy has arisen recently, in different localities, on the question: When and under what circumstances are municipal ordinances valid and enforceable which regulate the kind and quality of gas that must be supplied by the gas franchise holder?

Obviously, the answer to this question is dependent, to a great extent, upon the effectiveness or validity of state laws and city ordinances which define abandonment of service.

First, it is important to know that the modern higher courts hold that where a state law defines acts which must be performed before abandonment is legal, an abandonment of service, plant, or equipment is not legal, whether intended or not intended by gas company officials, until such acts have been fully performed. This law is effective although new city ordinances are enacted and in effect provide for abandonment of such service. Also, new state laws or city ordinances automatically repeal older laws and ordinaces, where confliction or contradiction exist between the older and newer laws and ordinances. All of these important points of law were decided by the higher court in the case of City of Cincinnati v. Public Utilities Commission, 30 N. E. (2nd) 797, reported January 22, 1941.

The facts of this case are that on June 30, 1939, the council of the city of Cincinnati passed a five-year ordinance (1) fixing gas rates and (2) also providing that the Cincinnati Gas & Electric Company should furnish *undiluted natural gas* to its consumers in that city. The company refused to accept the terms of the ordinance and appealed to the Public Utilities Commission of Ohio.

During the trial testimony was given which showed that the gas company has been in existence since the year 1837, and during that period has operated under several franchises of varying terms. First it served artificial gas until the year 1905. From that time until 1925 the franchise provided for the supplying of natural gas. From that year until 1930 the franchise likewise provided for service of natural gas but permitted this to be supplemented with artificial gas. A later franchise provided for "natural gas or mixed gas (natural gas supplemented with artificial gas)" and this arrangement prevailed until the passage of the above mentioned ordinance in 1939, the terms of which require the furnishing of undiluted natural gas and hence prevent the further supplying of artificial or mixed gas.

This mixed gas service consists of furnishing a mixture of four varieties: (1) Natural gas delivered by the Cincinnati Gas Transportation Company, (2) so-called stabilized natural gas obtained from the Ohio Fuel Gas Company, (3) gas manufactured by the Cincinnati Gas & Electric Company itself in its own plant in that city, and (4) coke oven gas manufactured at its plant located near Hamilton, Ohio.

The important point in the litigation was that if the gas company shall be required to operate under the 1939 ordinance, three of the four varieties of gas now served must be discontinued.

The Public Utilities Commission considered the testimony presented by both the gas company and the counsel for the city and held that the gas company need not comply with the terms of the 1939 ordinance.

The city appealed to the higher court, and two old statutes were introduced before the court. The statutes provide that no main pipe line, gas line, power station, or service station of a public utility, *or the service rendered thereby*, which has once been laid, constructed, opened and used for public business shall be required to be abandoned unless such utility desiring to abandon same shall first make application to the public utilities commission in writing who shall thereupon cause reasonable notice thereof to be given, stating the time and place fixed by the commission for the hearing of said application.

Therefore, the higher court held that the sole question presented was whether the effect of the 1939 ordinance passed by the Council of the city of Cincinnati was to require the gas company to "abandon or withdraw" its present service of mixed gas.

After carefully considering all testimony the higher court held that, in effect, the 1939 ordinance required the gas company to abandon its service, which had consisted in supplying mixed gas. Therefore, since abandonment of this service had not been carried out in accordance with the above mentioned two older state laws, and no application, notification, or hearing respecting abandonment of this service had been presented before the Public Utilities Commission, the higher court held the 1939 ordinance not effective to compel the gas company to supply only undiluted natural gas. This court said:

"Would this amount to an 'abandonment' or 'withdrawal' of service within the contemplation of state laws Sections 504-2 and 504-3, General Code? A careful study of the record clearly convinces this court that under the particular circumstances of this case the required change in the nature of the service is so substantial as to be tantamount to an abandonment and withdrawal."

In answer to a contention of the city counsel that the 1939 ordinance was a mere continuation of the earlier ordinance which specified natural gas, the court said:

"Likewise this court finds itself unable to agree with the claim of the city that technically the present 1939 ordinance involves merely a restoration of service of natural gas as provided in the franchise in effect at the time the foregoing state statutes were enacted. This theory erroneously presupposes the ineffectiveness of the numerous intervening franchises which neither the city nor the company then considered as within the purview of these statutes."

Therefore, the legal effect of this important higher court decision is, first, new or intervening state laws or city ordinances automatically repeal older laws and ordinances, provided, the intervening laws or ordinances conflict or contradict the older ones; and, second, abandonment of gas mains, equipment, plants or service is not legally effective unless provisions of state laws are complied with. Therefore, a late city ordinance cannot in any manner cause abandonment when provisions and requirements of state laws have not been fulfilled.

Validity of Franchise

Actually, a franchise is a contract which justifies a public utility to expend money under anticipation of ultimate and reasonable profits. The contract, also, must assure citizens of certain well defined benefits and conveniences. However, from a legal viewpoint, a franchise is a contract which grants certain rights to the public utility. In order to correctly interpret the legal rights, obligations and duties of the parties to a franchise, reference must be had to prior higher court cases interpreting various clauses and provisions.

First, it is important to know that since special privileges granted by a state or municipality are to be strictly construed, no franchise is ever construed to be perpetual, nor is an unreasonable regulation valid, whether it is in the nature of a contract, or otherwise, unless it is so declared in clear terms, or by necessary implication under the provisions of the state law. See Birmingham, 79 Ala. 465.

The state legislature may give to a city or other municipality the right to grant franchises, or enact reasonable regulations and it may limit the terms of the regulations or franchise. In other words, a city when contracting for use of its streets and highways, has only those rights and powers which are expressly given by state laws, or which arise by necessary implication.

Modern higher courts hold that a state law authorizing municipalities to grant a franchise must be strictly construed. Unless the law clearly authorizes municipalities to grant perpetual franchises or other special privileges, while the municipality may grant a franchise of any reasonable length of time, it cannot grant a perpetual and permanent franchise. See Des Moines, 159 Iowa 259; Joseph Waterworks, 570 R. 586.

Also, in Cedar Rapids Water Company, 91 N. W. 1081, the higher court said:

"Grants or franchises in perpetuity, or for unreasonably long periods of time, are generally regarded as against public policy; and, if ever valid, the authority therefor must be found in the Constitution or statutes of the state."

When Contracts and Regulation Are Constitutional

Equality within the gas corporation or consumers' class is all that is required to meet the test of constitutionality. In other words, a gas regulation is considered uniform when it is equally applicable to all gas companies and to all consumers in a particular classification.

Finally and in brief, when determining the validity of a gas regulation, the test is this: Does the classification affected by the regulation rest upon a relevantly rational basis and is the regulation uniform in respect of those similarly situated? Various higher courts have held that the boundary between what is permissible and what is forbidden by the constitutional requirement has never been precisely fixed, and is incapable of exact delimitation. Therefore, the courts must consider all testimony before deciding whether a gas regulation or law is valid.

Another important point of law is that the courts have consistently held that gas companies always are subject to police surveillance and control in the interest of public morals, and it is the right and duty of municipalities under express charter or state statute powers, and under the state under general exercise of its police powers, to regulate, permit or forbid, or require performance of certain acts on the part of gas company officials.

However, the modern courts are in accord with the principle that the *exact* words which formulate a constitutional provision, state statute, city ordinance contract, or regulation must be intrepreted exactly in accordance with their actual meaning in order to render a justifiable decision. And, furthermore, circumstances may exist under which a state law may affect a gas company only at the time the law was enacted.

Wilful Intent Must Be Proven

In many states laws are effective which require gas companies, and other corporations, to file certain kinds of reports such as cost of the visible physical properties, etc.; annual cost of operating such plant; gross earnings from any such plant and the like. Generally speaking, these state laws provide for payment of heavy penalties by corporations whose officials "wilfully" fail to make these reports. Therefore, it is important to know that the term "wilfull" means deliberate intention or set purpose to omit to perform a required duty; deliberate purpose to accomplish something forbidden; a determination to execute one's own will in spite and defiance of the law; a purpose to do wrong; an evil intent without justifiable excuse, or knowledge and a purpose to do a wrong act.

For illustration, in City of Baird v. West Texas Utilities Company, 145 S. W. (2nd) 965, reported January 21, 1941, it was shown a municipality brought suit against West Texas Utilities Company, a corporation, seeking the recovery of penalties in the aggregate sum of $44,700 claimed to be due under authority of the provision of a state law. This law provides that all utilities furnishing gas or light to inhabi-

(Concluded on page 66)

What Do You Know About This?

● During the past six months approximately one-third of the gas companies in the United States have, in response to our advertising, requested and received complete information concerning the new Monmouth Humidity Conditioner for radiator heated homes.

The chances, therefore, are two to one that *your company* is not yet in possession of the facts on this remarkable gas fired unit. It opens a new field for gas and a new health-opportunity for millions of homes which heretofore have been blocked off from vital humidification.

Aside from its efficiency and complete practicability, the most interesting thing about the Monmouth Humidity Conditioner is *ease of installation.* On this score your merchandising department will be very pleasantly surprised. The unit is entirely divorced from the heating plant. The only "alteration" required is an opening for a single small register.

Here is a new opportunity for gas. The complete story should be in your files. Why not write us today?

MONMOUTH PRODUCTS CO.
1939 East 61st Street Cleveland, Ohio

MONMOUTH
The Greatest Name in Humidification

Two New

MONCRIEF
Gas-Fired
Winter Air Conditioners

Introduced to the trade only since the beginning of this year, these two units represent the very latest developments in engineering and styling. Their capacities are exceptionally high for the more compact spaces they occupy. Automatic gas controls govern all operations. A diaphragm valve with gas-actuated hi-limit control is standard equipment. Burners, combustion chambers and heat-transfer sections are all-cast-iron, extra durable and corrosion-proof,—designed so that every part is effective radiating surface. Gas travel is always horizontal and upward. Cabinets are finished in smooth baked gray enamel with interesting crater effect.

Standard type is made in sizes from 70,000 B.t.u. input Vertical type, in two sizes, 70,000 and 85,000 B.t.u. input. Cabinet is 26" x 32" x 72".

Series "GG" Gravity Gas Furnaces. Efficient, economical and moderately priced. Cabinets beautifully finished. Advanced design and construction throughout.

Write for catalogs

MONCRIEF ENGINEERING SERVICE *is freely available* for estimating and laying out installations.

THE HENRY FURNACE & FOUNDRY CO.
3484 E. 49th STREET · CLEVELAND, OHIO

Cut Job Costs . . .

Increase Job Production . . .

ON ALL PHASES OF GAS PIPE LAYING

with "CLEVELANDS"

No need to worry about results when you use "CLEVELANDS". Past and present performance — from coast to coast — for over twenty years is your guarantee of long-lasting satisfaction.

"MODEL 95" ("THE BABY DIGGER")

←——— For All-round Gas Trenching

Here is the famous "BABY DIGGER," the pioneer small trencher — known and used almost universally throughout the gas industry. Small in size — but big in performance . . . light in weight — tough and dependable — compact and portable . . . yet extremely fast.

Its wide range of cutting widths and all 'round value have made the "MODEL 95" supreme as a general purpose gas company trencher.

Cutting widths — 12" to 24" — Depths up to 5' 6".

● "MODEL 75" — SERVICE DIGGER ●——→

Again "CLEVELAND" solves the problem.

Here's a still smaller, lighter and more inexpensive machine for digging smaller diameter lines, house service, etc.

Small companies with limited programs — as well as larger companies who use it to supplement their larger trenchers, have found the "MODEL 75" ideal. Weighs only 7,000 lbs. — is but 45" wide.

The "MODEL 75" is the last word in *portability*.

←——— ● "MODEL 80" — BACKFILLER ●
TAMPER — PIPECRANE

Important savings on the backfill and pipelaying operations too, are made available with the "MODEL 80".

Of typical "CLEVELAND" compact design, quality construction and portability, the "MODEL 80":—

Backfills the trench—Compacts it—Is quickly convertible for laying or unloading pipe, setting valves, governors, etc. An unusual machine built to the requirements of your work.

Let Us Send You Detailed Information On These MONEY-SAVERS.

THE CLEVELAND TRENCHER COMPANY

20100 St. Clair Ave. *"Pioneers of the Small Trencher"* Cleveland, Ohio

CLEVELANDS

Economical Trencher Operation for Widespread Gas Divisions

By

J. E. C. Currens

Pacific Gas and Electric Co.
San Rafael, Cal.

1. **Definition of the Special Operating Conditions of a Widespread Gas Division.**
2. **The Ideal Machine to meet above conditions.**
3. **Various existing machines studied in search for the Ideal above.**
4. **Practical machine finally evolved.**
5. **Division dispatching setup to use machine economically, an overall plan.**
6. **Costs.**
7. **Conclusions derived from a year's operation on the above plan.**

FOR YEARS it has been felt that ofttimes the wrong digger for particular conditions was used and further that diggers were not used as universally as possible. Many jobs on both mains and services were not dug by machine because of their isolated locations, because of short length and because of cramped operating room.

Perhaps our particular conditions in North Bay Division of the Pacific Gas and Electric Company should be given to present clearly our problem. Our organization serves 40,000 customers, in five centers and their attached suburban areas. The area of the Division is approximately 50x30 miles with a population of 110,000. The Division Superintendent's office is in one corner of this area surrounded by one-third of the customers; the other two-thirds are evenly divided between two districts and four centers varying from twenty to forty miles distant.

Only 30,000 of our customers are in urban centers, 10,000 are scattered along country roads between towns. In one suburban area a triangle eight miles on a side, we find a complete crisscross grid of gas lines supplying small chicken farms averaging in size less than two acres. All of these conditions illustrate the distance a trenching machine would travel between jobs. The work is well distributed between districts. We install 110,000 feet of line per year and 2300 house services. So to cover this spread of work a digger must travel an average of over fifty miles per week. (See Map I.)

In addition to the above difficulties, at least one-third of the work lies in the narrow winding roads and streets of the Marin District. The streets or roadways are usually paved but the sidewalks are graveled or non-existant. We have blocks and blocks in natural condition except for a paved road center, much the same condition as the famed "Carmel Artists' Colony." The situation arises in Marin not from the esthetic taste of an artist constituency but rather from the desire of property owners to make their homes a woodland retreat. A trencher which could work in narrow sidewalk and parking areas between poles, trees, mail boxes, fences and hedges would have a field day and would encounter very little concrete paving. The only inviting feature of this type of work to the ordinary machine digger is the length of the house service.

Summarizing, an ideal machine digger should meet several very definite conditions.

First: The trencher should move from job to job with ease of an ordinary truck. This would include load- and unloading, if by trailor.

Second: The trencher should be capable of setting up and digging 100 feet and get away to the next job at a saving. This would leave only the pipe stringing, welding, fitting and laying and backfilling. On this job the work remaining could be easily completed with three men.

Third: The trencher should excavate a trench only wide enough to insert the ordinary main laid in purely distribution work. We rarely install over 3″ lines in high pressure districts. Ninety-two percent of our main installed last year was 4″ or under. This would require a trench little over 6″ in width. As we will see later, it is possible to make money with trenchers digging 12″ and 14″ ditches but we lose in the overall picture. This loss is in direct proportion to the excess width over 6″.

Fourth: The trencher should be able to place the ditch so that its

Cleveland Service Digger

Presented at the Spring Technical Conference Pacific Coast Gas Assn., March 27 and 28, Los Angeles, California.

TABLE I

Specifications of Available Trenchers

	1 16-S	2 405	3 64-B	4 75	5 Ideal
Cutting width	12½″	8″	8″	8″	8″
Cutting depth	5½′	3′0″	3′0″	3′6″	3′6″
Width	7′0″	4′2″	4′0″	3′8″	3′8″
Length	28′0″	23′10″	16′6″	14′10″	14′10″
Digging unit	Wheel	Slanting Boom	Vertical Boom	Wheel	Vertical Boom
Mobility, road	30 mph	20	2 mph	2 mph	25 mph
Ability to dig at Min. distance from Wall to Ditch Center	3′6″	10″	19″ (either side)	22″	18″
Ability to dig test-holes, square end.	None	Good	Good	None	Good

center line is not over 18″ from a wall or hedge.

Fifth: Since the digger will many times be required to start ditch from a point close to an obstruction and ofttimes be called upon to dig test-holes, a vertical boom seems practical. A vertical boom leaves a minimum of undug earth on a "rise-over" over a branch line. Most sewer laterals can be handled more cheaply by cutting them but this is not the case with telephone ducts and other laterals, some of which are expensive to repair.

All of the above requirements boil down to the following five points:

1. A road mobility of 30 M.P.H.
2. A quick stop and start.
3. Dig a 6″ to 8″ ditch.
4. A side clearance of 18″ to ditch center line. 4′0″ wide.
5. Vertical boom or ability to start at a wall.

A Study of Existing Trenchers for the Ideal Machine

The obvious first move in looking for a trencher for our Division was to look over the field of self-propelled machines. We mean machines which could dig out a job then "up" the digger unit and proceed at thirty miles per hour to the next job. Such a machine was found and it is busy every day on jobs vastly different from ours. It simply could not be used in a sidewalk area between a property line and a row of trees. The machine is illustrated in Photo #1 and specifications in Column 1 of Table I. The machine is very successful in open field work or with a clearance of seven feet.

Some thought was given to building up a special machine to meet the five requirements. A start was considered with an industrial tractor but two difficulties at once appeared. Pneumatic tires are not the best foundation for digging shales and rocky soil. Second, the narrow width imposed on the design and the high folded boom made an unstable machine for fast road travel. So it was apparent if we were to get a streamline digger program under way that we would be forced to accept some compromises.

About this time a National manufacturer came out with a special "Service Machine" which seemed to hit pretty close. The machine was of proven design and a type with which we were familiar. The machine was put to work and a year's costs have been kept and are submitted herewith. The machine is #4 in the Table of Specifications, Table I.

Please refer to the list of requirements, there were five, this digger very well covers, #3, an 8″ ditch, #4, a center distance of 18″ it digs to 22″ and has the 4′0″ width. It is deficient on mobility #1 being able to travel at two miles per hour instead of thirty and finally it is deficient on #5, ability to cut down hand work to a minimum on "rise overs" and at test-holes and walls.

To get mobility we designed a special trailer for quick loading and used a truck for mobility. Photo #4 shows the trailer. This unit seems to work out well with a skilled operator. There are some traps in its operation would could be removed by the addition of cushioning cylinder. Loading is practically effortless and a unit can be on its way in five minutes without any effort of handling skids, blocks and bridges. A mobility of forty miles is easily possible. Ofttimes the unit has dug out three short jobs less than 300 feet and moved thirty miles. A little more insistance on required features could perhaps have increased its scope another ten percent.

Costs

(See Table II)

With the mechanical question apparently at least workably met, let's look at the economics.

Costs for short scattered jobs can no more be figured on the calculated expense for a test run of, say, a 100 feet any more than the cost of operating a battleship can be checked by a shakedown run of 100 miles. It is the end of the year figure that counts. This figure includes delays, poor dispatching, and a dozen items not usually associated with the cost per foot.

We have considered the following:

1. First cost.

TABLE II

1940

Yearly Report on Trencher Operation in North Bay Division

Total feet dug by trencher including services		76,229
Total footage of main dug by trencher		59,243
Total feet of main dug either by hand or machine ←(1)→		110,607
Total number of jobs worked		178
Total days trencher was operated		161
Total hours trencher operated		468
Total hours moving outfit job to job		193
Total travel of trencher and trailer, miles		2629
Total cost of operation, including operator labor, moving, labor greasing, repairing, repair parts, fuel oil grease		$1,267.83
Total cost of truck for towing 2629 miles x .081 cost per mile		213.00
Total amortization Cost for: Digger	$4470.00	
Trailer	700.00	
	$5170.00	
@20%		1,034.00
Interest of 6% on investment on reducing scale		186.12
Revised total cost as above		$2,700.95
Cost per foot including everything: 2700.95 / 76229 = Cents per foot		3.54
Dollars per foot		0.0354
Number of services run during 1940		2300
Feet of service, machine trenched		(1)11003
Total feet of services, machine or hand dug		158335
Cost of digging by dispatching method, Dollars per hour ($270095 ÷ 468′)	$ 5.77	
Average travel per job, Miles per job (2629 ÷ 178)		14.8 miles
Average length of main on each job (59,243 ÷ 178)		330 feet
Average road speed moving, Miles per hour (2629 ÷ 193)		13.6
NOTE: This includes loading and unloading.		
Average digging speed (76,229 ÷ 468 ft/hr)		162.5
% of all main dug by machine (59,243 ÷ 110,607)		53.5%
% of all services dug by machine		6.9%
Average length of service (158,335 ÷ 2300)		69 feet

SEGREGATED COSTS OF OPERATING CLEVELAND TRENCHER S-5 DATE September 1940

MACHINE DATA	DIVISION	MARIN DIST.	VALLEJO DIST.	SONOMA DIST.
Jobs worked	20	2	13	5
Operating Days	19	3	14	2
Hrs. Trenching	73½	13½	52½	7½
Hrs. Moving	22	3	13	6
Hrs. Greasing	3		3	
Hrs. Repairing	12		12	
Trailer Miles	300	100	95	105
Feet Trenched	11139	2230	7063	1846
Avg. Dim. Ditch	10"x30"	10"x30"	10"x30"	10"x30"

LABOR	HOURS	COSTS	HOURS	COSTS	HOURS	COSTS	HOURS	COSTS
Operator	73½	79.12	13½	14.68	52½	56.28	7½	8.16
Moving	22	23.62	3	3.26	13	13.84	6	6.52
Greasing	3	3.26			3	3.26		
Repairing	12	12.98			12	12.98		
Helper								
Moving								
Greasing								
Repairing								
FUEL								
Gasoline	119Gals.	19.63	32Gals.	5.28	73Gals.	12.04	14Gals.	2.31
Oil	22 Pts.	12.45			22 Pts.	12.45		
Grease	10 Lbs.	3.20			10 Lbs.	3.20		
Parts Repair		15.75				15.75		

SUMMARY OF COSTS BASED ON OPERATION OF MACHINE

	Costs	Cents Per Ft.	Cost $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.
Operator	79.12	.71	1.08	14.68	.66	1.09	56.28	.80	1.07	8.16	.44	1.09
Helper												
Gasoline	19.63	.18	.27	5.28	.24	.39	12.04	.17	.23	2.31	.13	.31
Oil & Grease	15.61	.14	.21				15.71	.22	.30			
Repairs	28.73	.26	.39				28.73	.4 1	.55			
Moving	23.62	.21	.32	3.26	.14	.24	13.84	.20	.26	6.52	.35	.87
Auth. ¾ Per Day												
TOTALS	116.81	1.50	2.27	23.22	1.04	1.72	126.60	1.80	2.41	16.99	.92	2.27

PERCENTAGE OF DITCH TRENCHED AND HAND DUG.

	%	Ft.	%	Ft.	%	Ft.	%	Ft.
Trenched	72	9103	83	2170	82	5522	68	1411
Hand dug	28	3615	17	661	18	1294	32	660
Total	100	12718	100	3831	100	6816	100	2071
Ft. per Hr.	11139 ÷ 73½ - 152		2230 ÷ 13½ - 165		7063 ÷ 52½ - 135		1846 ÷ 7½ - 246	

SERVICES

Trenched	15	2036	2	50	23	1541	11	435
Hand dug	85	11859	98	3366	77	5124	89	3369
Total								

2. Overall labor cost.
3. Fuel, oil, and grease.
4. Repairs, labor, and parts.
5. Number of feet dug.
6. Life of machine.

Table # 2 includes twelve months experience with the digger shown in Column 4, Table #1.

This table also includes other pertinent data which reflect the type of work the machine was doing. With everything in, we came out with a cost of three and one-half cents per foot on an annual basis. This figure should be shaded somewhat as the backfill was on an 8″ ditch instead of an 18″, as would be the case if the line should have been installed in a hand dug ditch.

If hand backfilling for 18″ ditch costs us $0.08 per foot, an 8″ ditch will cost us three and one-half cents or an indirect associated saving of $0.045 x 76,229 feet or $3450.00.

Saving for Division for 1940 Operation

First, as we can see above, we have a reduced backfilling cost of $3450.00 because we do less backfilling.

Second, if hand trenching costs us $0.16 per foot we have a saving of twelve and one-half cents per foot on 76,229′ or $9529.00 per year. With the saving in backfilling above, the machine and the dispatching procedure saves us $1000.00 a month and over.

Considering the fact that the machine in question worked only 161 days out of a possible 250, allowing for repairs, we believe the machine could earn or save:

$$161 : 13{,}750' :: 250 \times \frac{13750 \times 250}{161} =$$

$21,300 per year.

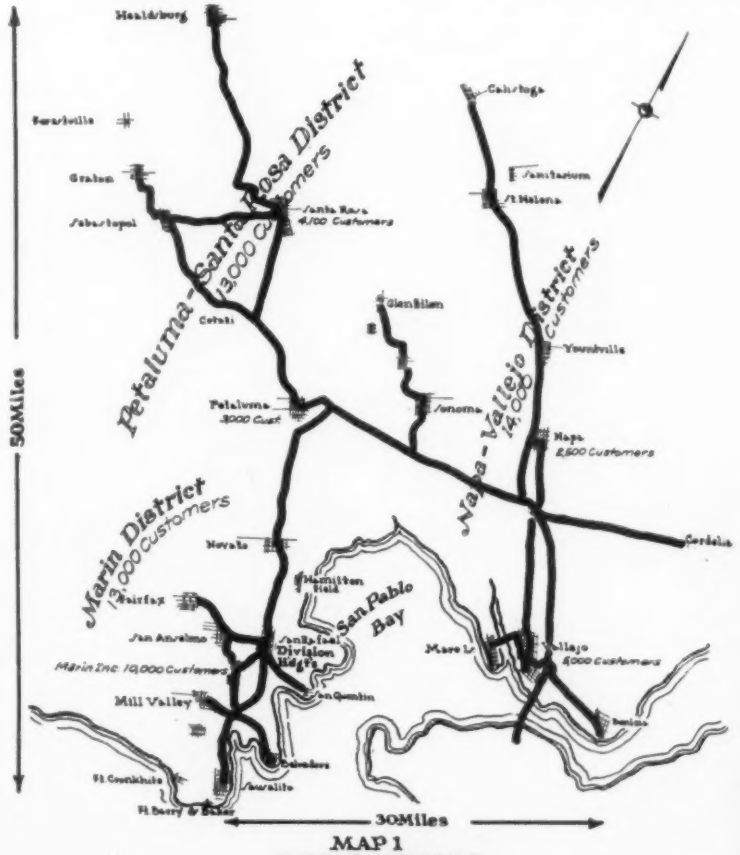
With some machine which met all of the requirements with more intensive dispatching a saving of $1500.00 a month would be possible.

Dispatching

A glance at the accompanying map of North Bay Division will show the necessity for intelligent dispatching. Money can be made by grouping small jobs, picking up short jobs on the way to larger ones, breaking up long jobs to let crews "closeup." It is questionable saving in our territory to leave a lot of ditch open for long periods. We are subject to loss of ditch and injury to the public. A central dispatcher in the Superintendent's Office is used. He is posted on jobs coming up in the different districts and so routes the digger to best advantage.

Synchronized Job Operation to Make Digger Effective

In former years it was very ordinary procedure to start a large job by going into the local help supply and building up a crew of thirty or forty men. These men needed to



MAP 1
NORTH BAY DIVISION
PACIFIC GAS and ELECTRIC CO.
DISTRIBUTION OF CUSTOMERS
AND
DISTANCE TO BE TRAVELED BY TRENCHER

Loading the Digger on Trailer

know nothing but digging. When the job was finished they were discharged where the job was finally completed. In later years we are using permanent crews of specialists, each man an expert in his own duty, and supplying these men with continuous year-round employment. Men are paid more because they are required to know more and because the units of completed work per man are greater. These men do not lose a day's work in a year and are useful home owners. The digger fits into this personnel situation perfectly. It opens up the job for the specialists, pipe liners, welders, fitters, layers, tarmen, backfillers, servicemen, compressormen, and pro-rates the job without large masses of temporary short-lived help.

Before the digger arrives, the welder and liner crew is stringing, tacking and welding up the line, working in the street well out of the way of the digger. The digger arrives and cuts service ditches first. This gives location for service tees which are welded up on top of the ditch. Next the main line is dug and pipe installed as quickly as digger passes. The procedure we usually use is to lay the main completely then cross trench for services and connect in the ditch. This procedure is perhaps not as efficient as the above, but has the advantage of closing up as you go. With machine backfilling the heaviest job is the tamping usually necessary in suburban jobs.

Entrances, barricades, bridges, and lanterns are points which must be watched. This is a duty of the local district who usually assigns one man to the job—he works right with the digger. Using a deflector on the digger, much of the work of opening the spoil bank is obviated. The deflector can throw dirt a good four feet either way, leaving a good eight feet of opening.

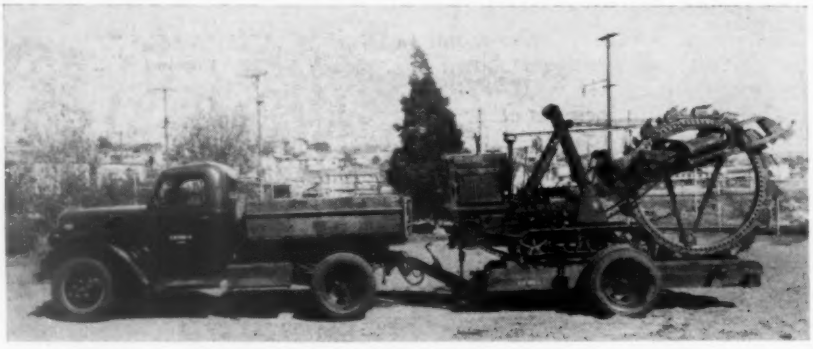
Conclusions to be Derived from this Study

First we believe manufacturers could look at the overall picture and assist the member companies not to just get a machine, but buy a process. Such accessories as trailers and backfillers are not just machines to be added to a manufacturer's line but should be part of a well set up plan or procedure, and should come with the machine. Hundreds of miles of line are not dug each year because Superintendents are not set up to do the work, so resort to the simpler expedient of hiring a "bunch" of men with all the heartaches that come with dropping the crew, the worry to foremen keeping them going and laying out work, thousands of hours of rush payroll accounting, cost accounting and the train of work that is necessary to keep men on the payroll. All this as contrasted to the quite simple picture of a machine, a crew of year-round specialists who feel they are not just "dirt slingers."

The trailer situation is good, with a few simple improvements, but backfilling and tamping has not been clearly solved, and could well become a study for next year.

The program should be extended next year. Our percentage of machine trenching will be higher and services will be given more attention.

Ditching at three and one-half cents a foot also pays out well as an operation. When a year's work was successfully completed on jobs only 330 feet long on average and 14.8 miles apart, we can see that dispatching for a scattered division pays and gives us the advantages of long line construction.



Digger Hooked Up—Ready for Transport

DATE ..... OPERATING REPORT—TRENCHER NO. .....

Gm or Wo # ..... Acct. # ..... Div. ..... Job Card # .....
Location of Digging. Inc. ..... Sub. ..... So # .....

	Auth. Gm.-Ft.	Wk. So.	Mach. Gm-Ft.	Dug. So-Ft.	Trler Miles	Gm. Wo. or So.
Ft. forward					.....	Wk. 100%
Ft. this job					.....	Wk. Hand dug.. %
Ft. to date					.....	Wk. Trenched.. %

Payroll Data	Accounting Data	Mach. Trenching Time
Hrs. act. trenching	Moved from	
Hrs. moving	Miles moved	
Hrs. greasing, oiling	Req. no. of gas, oil, materials, etc.	
Hrs. repairing	No. ..... S.S. #	
Daily time for job	See other card for total job #	

ENGINEERING DATA

Trench-Length ..... Width ..... Depth ..... Soil .....
Gas Used ..... Gals. Oil .....Pts. Grease ..... Lbs. Subsoil .....
Remarks on reverse. Time start. ..... Truck # ..... Trler # .....
(Division Copy) Trencher Operator .....
SSA # .....

"POSIES" FOR PERFORMANCE

are cast our way by present users of ***LAVINO "ACTIVATED" OXIDES***

They applaud the fact that, for all loads from traces to the heaviest, LAVINO "ACTIVATED" OXIDES display a maximum capacity and activity . . . set a ceiling on purifying cost far under that with ordinary oxides.

Savings in material, savings in handling reflect credit on those responsible for this phase of operations. *How* and *why* these savings can be made is the interesting story we'd like to tell you. Write us for details; no obligation, of course.

E. J. LAVINO and COMPANY · 1528 WALNUT ST., PHILA., PA.

All sizes up to 3,400 cu. ft. capacity

Meters
Diaphragms
Repairs
Provers
Pumps
Calorimeters
Wet Meters
Gauges
Apparatus

METER REPAIR PARTS

FOR

ALL MAKES — ALL SIZES OF METERS

LARGEST GAS COMPANIES NOW USING OUR PARTS

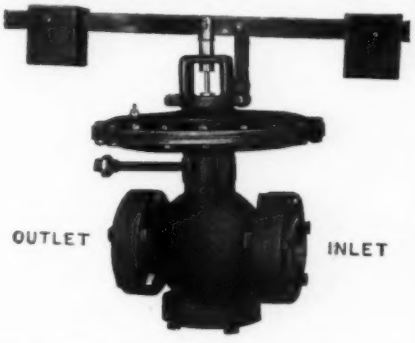
SEND FOR OUR CIRCULAR ON METER REPAIR PARTS

SAMPLES AND PRICES GLADLY SENT

— O —

LAMBERT METER CO.

PLAINFIELD, NEW JERSEY



Fulton Weighted Illuminating Regulator

For Medium Inlet Pressures

Where medium or low inlet pressures are used, or where the difference between inlet and outlet pressure is very slight, the Fulton Weighted Illuminating Regulator gives the most perfect control. Designed for either natural or manufactured gas. No stuffing box. Practically no friction. Highly sensitive. Write for Bulletin 2574 giving full information, also new Catalog of C-F Regulators for all requirements of pressure control.

***The* CHAPLIN-FULTON MFG. CO.**

28-40 PENN AVE. CF PITTSBURGH, PA.

FOR want of a nail the shoe was lost; for want of a shoe the horse was lost; and for want of a horse the rider was lost; being overtaken and slain by the enemy. What Franklin said 200 years ago applies today thruout the land. It means doing one's job well, whatever it may be. Purification, a small but vital link in gas production, is just one of those "horse-shoe nails" that mean so much. Here economy *plus reliability* count—and that is why the gas industry in the past year repeat-ordered over 1,500,000 bushels of GPM Iron Hydroxide.

Gas Purifying Materials Co.
Long Island City, New York

GPM IRON HYDROXIDE

Industrial Gas Engineering

By

Raymond F. Mann

Twenty-one chapters of practical information for Industrial Gas Engineers and Salesmen.

It describes principles of operation and much of the equipment used in a variety of industries. It gives examples of calculations, also operating characteristics and data.

Appearing originally as a series of articles in AMERICAN GAS JOURNAL, the author, with 18 years practical experience in the industrial uses of gas presents the series in book form.

100 Pages 8½ x 11. Strong flexible cover.

Every industrial engineer or salesman will need his personal copy. Order today the number of copies you require as the edition is limited.

Only $1.50 a Copy

TABLE OF CONTENTS

The Tools of the Industrial Gas Engineer	5
Industrial Gas Heating Calculations	11
Industrial Gas Burner Systems	17
The Choice of a Burner System	21
The Immersion Burner	25
Gas in the Foundry	31
The Baking of Cores	34
Galvanizing	38
The Heat Treatment of Metals	42
The Melting of Metals—Part I	47
The Melting of Metals—Part II	53
Gas-Designed Steam Boilers	58
Gas and the Bakery	62
The Direct Fired Air Heater	67
Use of Gas for Drying in Industrial Plants	72
Industrial Gas and the Competitive Angle—Part I	76
Industrial Gas and the Competitive Angle—Part II	80
Industrial Gas and the Competitive Angle—Part III	84
Industrial Gas and the Competitive Angle—Part IV	89
The Industrial Gas Engineer and Space Heating	93
Selling Industrial Gas	97
Combustion Characteristics of Typical Gases	100

American Gas Journal 53 Park Place, New York

The Emergency Repair of Cast Iron Mains*

By

W. Boden

Technical Service Engineer, The Stanton Ironworks Company, Limited.

THE POSSIBILITY of pipe lines suffering damage as a result of enemy action renders the subject of emergency repairs a matter of prime importance, as any prolonged interruption of water, gas and sanitary services must be avoided.

At the outset it is necessary to realize that no one system of repair can be devised which is applicable to all types of fracture; working pressure, location of the damage, size of main and the age and nature of the affected pipes are some of the factors which require consideration before undertaking the work. In these notes, therefore, it is intended to refer to the subject in general terms and describe in detail a method devised by The Stanton Ironworks Company, Limited, a method which has much in common with other systems involving the use of mechanically made joints.

Routine Repairs

Sections of damaged main can be made good with ordinary socket and spigot pipe jointed with molten or fibrous lead. Such repairs can be carried out with reasonable expedition provided skilled jointers are readily available. Blackout restrictions or danger arising from escaping gas may preclude the use of a fire or stove for heating the lead, and therefore supplies of lead fibre should be available for such emergencies—also cold lead caulking is preferable and safer when dealing with water mains which, by reason of slight leakage at isolating valves, cannot be kept dry. The repair squad should have suitable pipe cutters available, and the necessary collars to make the final connection.

Repairs of this type, using the same size of pipe to effect the connection, are in the nature of permanent repairs, as in every respect the pipe line is restored to its original form.

Semi-permanent repairs can similarly be executed by using reducers or tapers and inserting a length of smaller diameter main. Provided the inserted length is not of appreciable length, the efficiency of the main will not be greatly affected, and the system possesses the advantage of making it unnecessary to carry an emergency stock of pipes embracing all diameters used in the supply or distributive system: a range of suitably graded tapers and a stock of several selected diameters of pipe will suffice to meet all emergencies.

Dealing with Large Mains

For large mains, generally in excess of 24 in. diameter, it is suggested that a permanent repair is the most satisfactory, as the work is in any case a major job requiring ample labour and efficient lifting tackle, and therefore little extra expenditure of time or money is involved in replacing the damaged portion with pipes of the same size and class.

In allocating stocks for repair purposes it is necessary to bear in mind that for all types of cast iron pipe of 12 in. size and over the outside diameter of the Class "B" pipe differs from and is less than that of the corresponding Class "C" or "D" pipe.

Little progress has yet been made in this country with lead substitutes for the open-socket joint, but their possibilities for emergency work should not be overlooked. A slaglike material which is poured into the joint has been widely used in America; this material expands on setting, and therefore avoids the need for the skilled and rather tedious process of caulking.

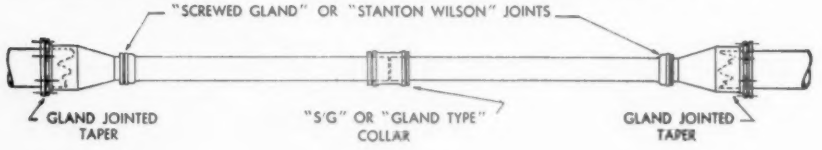
Sand-cement grouts are also used

An example of an emergency repair arranged for demonstration purposes by the Barnsley Corporation Water Department. The temporary main linking two broken ends makes a detour round an obstruction, and the photograph shows the use of the tie rods and clips

* *Reprinted from The Gas Times, London. Issue of March 1, 1941*

Fig. 1.

GENERAL DESIGN FOR SEMI-PERMANENT REPAIRS OF MAINS UP TO 24"



in America, and a cement-asbestos compound is now available on the home market: the various types of cement jointing material have proved satisfactory for normal pressures, but require some hours to set, and therefore their use delays the recommissioning of the main. Experiments have also been conducted with rubber latex compounds which suggest satisfactory jointing properties, but these compounds have the disadvantage, for emergency purposes, of a slow setting time.

Connections

Provided the damaged pipes conform, within tolerable limits, to standard external dimensions and are reasonably circular in section, connection can be made to them by mechanically jointed collars, sleeves or tapers, leaving the intervening section to be coupled by mechanically jointed pipes or some other means.

The various forms of mechanical joint offered for the tapers, sleeves or collars generally follow the principle of the compressing of a rubber gasket by a flange tightened by a series of bolts. Joints on the pipes used for the repair section may be formed of rubber gaskets compressed by unit external or internal housings or bolted flanges or by couplings embodying a rubber joint ring of U section. Certain designs provide for a length of hose to form the repair section.

Temporary Connectors

Devices for temporary repairs are also marketed which take the form of connectors inserted into the broken pipes and secured in a leak-tight manner by the pneumatic inflation of a tubular joint ring or by mechanical expansion of a rubber sleeve. The connectors are fitted with flanged or similar outlets to facilitate the connection of the repair section.

The advantages of mechanical joints for rapid repair are numerous: they are easy to assemble, are flexible and so provide for subsequent ground settlement; intelligent but otherwise inexperienced labour can quickly be trained in their use; and they can, where used for temporary or semi-permanent purposes, be taken apart and remain available for further use.

Where the damaged main was originally laid with mechanical joints the problem of repair is greatly simplified. All broken or partially damaged pipes can be removed by undoing the joints, and the restoration of the line accomplished by "marrying in" an equal number of similar pipes, provided that three full lengths are involved.

The illustrations Figs. 1, 2 and 3 explain the system of repair designed by The Stanton Ironworks Company, Limited, and are in themselves self-explanatory. It provides for the repair of mains up to 24 in. in diameter, enabling semi-permanent connections to be made on the larger sizes by the use of special tapers. For sizes up to 6 in. diameter, permanent restoration can be made using either collars or sleeves to connect to the broken pipe line. The tapers and sleeves are designed with a deep socket to accommodate the jagged spigot of a fractured pipe; where collars are used the damaged spigots should be cut square. A bolted type of gland joint is used for all connections made to the *existing* pipe line, as this design permits of an appreciable tolerance in regard to the external diameter of the old main.

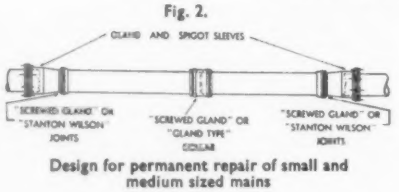
The repair section is constructed of Stanton spun iron pipes fitted, according to diameter, with screwed gland or Stanton-Wilson self adjusting joints, and the final closure is made by a screwed gland collar or bolted gland collar, again according to diameter. The table in Fig. 4, in conjunction with illustrations Figs. 1, 2 and 3, shows the range of tapers, sleeves and collars available and indicates the type of joint fitted.

Where bends are incorporated in the inserted section, anchorages are necessary if the working pressure is appreciable, and the photograph shows how this can be done by using tie rods and clips. Mains working at below 20 lb. per sq. in. need few or no anchorages.

Serious damage may demand the laying of long lengths of temporary main on the ground surface, and for such purposes mechanical flexible joints are ideal. Rapid laying, negotiation of easy curves by flexure of the joints and a hundred per cent. salvage value are the more important of their advantages when used for such purposes. It is necessary once more to stress the importance of providing suitable anchorages at all bends on pressure mains laid above ground.

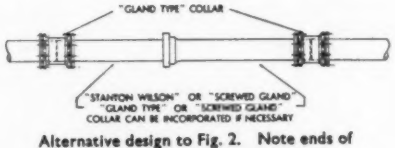
"SCREWED GLAND" PIPES AND COLLARS
AVAILABLE IN SIZES 3" 4" 6" 8" 10"

Fig. 2.


GLAND AND SPIGOT SLEEVES
"SCREWED GLAND" OR "STANTON WILSON" JOINTS
"SCREWED GLAND" OR "GLAND TYPE" COLLAR
"SCREWED GLAND" OR "STANTON WILSON" JOINTS

Design for permanent repair of small and medium sized mains

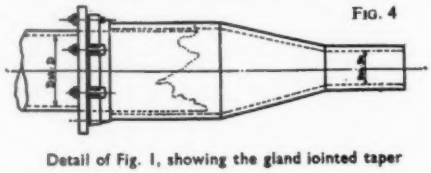
Fig. 3.



Alternative design to Fig. 2. Note ends of fractured pipes should be cut square

Dia. D ins.	5	6	7	8	9	10	B 12	C 12	B 14	C 14	B 15	C 15	B 16	C 16	B 18	C 18	B 20	C 20	B 21	C 21	B 24	C 24
Dia. D1 ins.	4	4	4	4	4	6	6	6	8	8	8	8	8	8	8	8	12 B	12 C	12 B	12 C	12 B	12 C

Fig. 4



Detail of Fig. 1, showing the gland jointed taper

Book Review

Public Utility Economics by C. Woody Thompson, Associate Professor of Economics, and Wendell R. Smith, Instructor in Commerce, University of Iowa. McGraw-Hill Book Company, Inc., 1941, 727 Pages, Price $4.50 per copy.

While designed as a text book for advanced students in economics and commerce, this book will be of great interest to executives of utility companies and public officials who have to do with regulation and rate making.

The authors have attempted to develop this book around a definite functional pattern. The material has been divided into four major sections. The first section deals with basic principles of legal and economic nature and is introduced by a brief sketch of the high lights of the history of the utilities. The next part considers the legal basis of regulation and the agencies of regulation. Part II accepts the predominant private ownership in the field and presents the steps in the development of regulative controls. This section closes with a description of the techniques of control.

The third section is confined to the primary problems with which regulation must deal. First and foremost is the problem of reasonable rates, one that occupies much of the time of the regulatory bodies. Under this problem fall the questions of valuation, rate of return, depreciation, and rates and rate making. A second primary problem relates to service standards. Logically, it is as important as reasonable rates; but since it has occasioned so little dispute, it can be disposed of in a short chapter. The third primary problem relates to security regulation. Although historically not a problem of the first water, it has become so because of the significant position that the billions of dollars of utility securities play in our American investment fabric. Finally, the authors have elevated the holding company to the rank of a primary problem of regulation. Definitely, the holding company has assumed such a ranking only since 1920. Formerly, its consideration would have been in the final section of this book. But as a result of the evidence gathered by the Federal Trade Commission in the investigation of the utility holding company and subsequent federal legislation, this problem has become one of primary importance.

Finally, the authors present in Part IV a group of special public utility problems. They have intentionally reserved for this section the discussion of public ownership. The book proceeds on the premise that public utilities, with one notable exception, (the water companies), are and will continue to be privately owned and operated. The authors do not, however, ignore the possibility of public ownership, and the reader will see that three chapters are devoted to that question.

Lincoln Appoints Consultant At Washington

The Lincoln Electric Company, Cleveland, Ohio, announces the appointment of Mr. B. J. Brugge as its Welding Consultant and Engineer at Washington, D. C. He will be engaged in consulting work having to do with the application of arc welding in the National Defense Program and will be available for such work with all governmental departments. He will be associated with T. A. Canty, Inc., Lincoln representatives in Baltimore, Maryland.

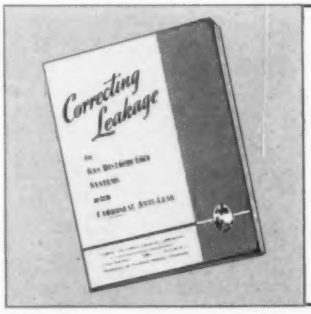
Mr. Brugge, who has been associated with Lincoln since 1931, was formerly in the Los Angeles office and until recently located in Houston, Texas.

"Carboseal" Anti-Leak Treatment

. . . the economical way to correct Leakage in Dry Bell-and-Spigot Joints

MORE than 265 gas properties are now using "Carboseal" anti-leak treatment in systems distributing dry gas . . . because it effectively corrects bell-and-spigot joint leakage for an indefinite length of time . . . and because it costs surprisingly little. Joints treated eight years ago are still tight today on the soap test. Average cost per joint, taken from the records of 16 users who treated over 200 miles of main, was 50 cents . . . One company buys "Carboseal" anti-leak in tank cars. Another buys regularly in car-load lots. Many companies have made "Carboseal" anti-leak treatment a standard maintenance procedure.

Over three years ago, the lower half of this one-inch rope was treated by immersing the end in "Carboseal" anti-leak until the liquid had climbed to the wire that binds the middle. The rope has been carried about exposed to the air ever since and was photographed in March, 1941. The marked swelling took place immediately after the rope was treated and illustrates the long-term effect of "Carboseal" anti-leak on the packing fibers of bell-and-spigot joints.



You, too, can benefit

"Carboseal" anti-leak treatment can do for you what it has already done for others in reducing unaccounted-for gas loss. Plan now to start using this effective, low-cost method to correct the leakage in the dry bell-and-spigot joints of *your* system . . . This 20-page book tells more about "Carboseal" anti-leak treatment—how to apply it by either the gravity or the hose method, how much it costs, and what results can be obtained. Write for a copy.

CARBIDE AND CARBON CHEMICALS CORPORATION

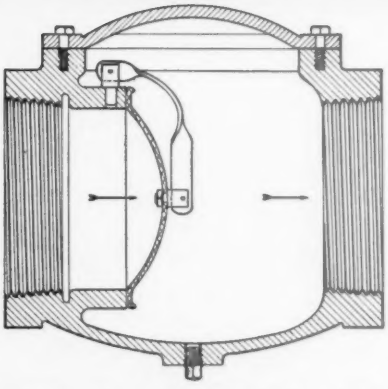
Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York, N. Y.

The word "Carboseal" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

Greater Safety - LOWER MAINTENANCE EXPENSE



Drawing above shows cross section of one of the most popular types of Connelly Back Pressure Valves. Note the easy access to flap thru top opening for removal, cleaning or inspection.

Write for Bulletin

with CONNELLY BACK PRESSURE VALVES

Insure your equipment against the dangers of reverse flow — extinguished pilots — and the double hazard of asphyxiation and explosion. Connelly Super Sensitive Back Pressure Valves provide a dependable, efficient check against this danger with no need of other expensive and complicated safeguards. The light weight valve disc is correctly balanced for extreme sensitivity, providing instant action when back flow occurs, yet exerting negligible resistance to normal flow. Sturdily built, in a wide range of styles and sizes — unusually simple in construction and operation — with removable cap making flap easily accessible for cleaning and inspection without removing valve from the line.

Play safe — install Connelly Back Pressure Valves NOW.

$255.00 in CASH for best gas equipment photos—17 prizes, from $5.00 to $100.00. Open to gas company employees and members of their families. Runs from March 1st to June 30th, 1941. Get started now. No cost or obligation. Write for Official Entry Blank

CONNELLY IRON SPONGE AND GOVERNOR COMPANY • CHICAGO, ILLINOIS ELIZABETH, N. J.

WORLD'S GREATEST all around ELECTRIC TOOL

DRILLS—GRINDS—SANDS
SAWS—POLISHES
SHARPENS—CARVES

The new WHIZ ELECTRIC TOOL is the handiest power tool ever made. A rugged tool for power and precision work. Drills through ¼ inch iron plate in 42 seconds or engraves intricate designs. Handles any material: Metals—Woods—Alloys—Plastics—Glass—Steel—etc. Saves time. Eliminates labor. Plug into any socket AC or DC, 110 volts. Chuck ¼ inch capacity. Ball bearing thrust. Powerful, triple-geared motor. STANDARD MODEL, with Normal Speed (uses 200 different accessories, instantly interchangeable). **Price Only $7.95.**

The only DRILL-TOOL with a full year's guarantee

FREE Accessory outfit (Value $2) includes set of drills, mounted 1½ inch grinder, sanding discs, cutting wheels, mounted brush, polishing wheel, carving burr, etc. FREE with each tool ordered NOW. We pay postage.

10-DAY TRIAL—MONEY BACK GUARANTEE

PARAMOUNT PRODUCTS CO.

Dept. 5AGJ 545 Fifth Ave. New York, N. Y.

GAS PLANT EQUIPMENT

UGI REFINERY GAS REFORMING PROCESS
UGI NATURAL GAS REFORMING PROCESS
UGI HEAVY OIL PROCESS

GAS DISTRIBUTION
PIPE LINE CONSTRUCTION

THE U.G.I. CONTRACTING COMPANY
A DIVISION OF
UNITED ENGINEERS & CONSTRUCTORS INC
NEW YORK PHILADELPHIA CHICAGO
MAXIMUM RETURN TO CLIENTS PER DOLLAR EXPENDED

• BARBER

Gas Pressure REGULATORS

for Reliability!

Certified by A. G. A. Testing Laboratory. Write for Catalog and prices on Barber Conversion Burners, Appliance Burners, and Regulators.

THE BARBER GAS BURNER CO.
3702-4 Superior Avenue
CLEVELAND OHIO

Sizes ¼" up

HAM AND VEAL LOAF
OYSTER CASINO
BOXTY PANCAKES
SUGARED EGGS
MORE GAS RANGES SOLD LAST YEAR THAN EVER BEFORE . . .
America's No. 1 choice!
TASTE WHY GAS COOKING IS WAY AHEAD
Now more than ever before, Modern Gas Cookery is America's No. 1 choice. Just by cooking Boxty Pancakes you'll see mighty good reasons why.
First, if you prefer fast-boiled potatoes your Giant Gas Top-Burner reaches boiling point with unequaled speed. Or the amazing "controllability" of Gas lets you prepare those potatoes the "waterless" health way with your Simmer Burner, saving all the precious minerals and vitamins. Also, only Gas, with its hundreds of different speeds, can give you just the frying temperature you want.
Other reasons why modern Gas Cooking is No. 1 choice in 17,000,000 American homes: complete automatic lighting . . . smokeless broiling . . . big, even-heat oven . . . unrivaled dependability . . . unequaled economy . . . perfect cleanliness.
Visit your nearest Gas Company office and see the latest 1941 Certified Performance and other Modern Gas Ranges today!
BE SURE TO TUNE IN ON WAAB EVERY WEEKDAY MORNING — 7:00 to 7:45 — for your "BREAKFAST HEADLINE NEWS" . . . another modern service brought to you by your GAS COMPANY.
MODERN MAGIC CHEF GAS RANGE
$106 with your old stove
pay less than 99¢ a week!
• Swing-out Smokeless Broiler
• Divided Cooking Top — Roomy Oven
• Smart Lamp and Minute Minder
• Automatic Top Lighting
HEAT-COOK WITH MODERN 2-PURPOSE KITCHEN HEATING RANGE!
When you change to thrifty Gas Kitchen Heating, you get a special LOWER Rate that may save you on all the gas you use. This clean, dependable modern service does away with all fuel lugging — brings controlled, even heat right into your kitchen.
BOSTON CONSOLIDATED GAS COMPANY
100 Arlington Street . . . HUBbard 7600 . . . or at any authorized merchandising dealer
MILLIONS AGREE . . . Gas is Best by Every Test!

Superiority of Gas for Cooking

The Boston Consolidated Gas Co., Boston, Mass., has recently started a new type of gas cooking advertising.

The plan is to counteract any negative attitude customers may have towards the future of gas cooking vs. electric cooking. It presents strongly and proudly the company's success in the gas cooking market.

It seems axiomatic that whatever hold electric cooking may have on the general public is chiefly psychological and not justified by performance.

Recipes are used to drive home and prove the facts of gas superiority, and the copy angle growing vigorously from the recipes themselves is specific proof of why Gas Cooking is America's No. 1 choice.

One of a series of newspaper advertisements used. Original size 5 column, 14½" high.

This type of aggressive promotion is the story all gas utilities can tell the housewives in the communities they serve.

Official Texas O.K. Given To Butane-Propane Hose

The gas utilities division of the Texas railroad commission, which handles matters relating to the petroleum industry in that state, has given official approval to its high pressure butane-propane hose, it is announced by The B. F. Goodrich Company.

Goodrich hose developed to meet the conditions imposed in butane-propane service are of combination construction, with synthetic rubber tube and rubber cover, in sizes from ⅜ inch to 3 inches. The hose has built-in static wire.

General requirements of this type hose are high resistance to the unusually penetrating and deteriorating action of these petroleum products and a relatively high burst to withstand vapor pressures at varying temperatures.

Connelly Photographic Contest

The judges selected for the amateur photographic contest being sponsored by the Connelly Iron Sponge & Governor Company, Chicago, March issue, page 48, are announced as follows: Samuel Insull, Jr., Chicago, Vernon G. Leach, Chicago, Lester J. Eck, Minneapolis.

Samuel Insull, Jr., formerly well known in the utility field, now associated with W. A. Alexander & Company, Chicago, has for many years been a member of the Chicago Camera Club.

Vernon Leach, chief combustion engineer of the Peabody Coal Company, is also a member of the Chicago Camera Club. He is well known as a pictorial enthusiast.

Lester Eck, general superintendent of the Minneapolis Gas Light Company, is known as one of the most enthusiastic amateur photographers in the Northwest. He belongs to the Gopher Camera Club.

The Connelly Contest which started March 1st and continues to June 30th is open only to officers and employees of gas companies and their families. It is reported that this contest has already caused tremendous interest among the picture taking fraternity in the gas industry.

THE GOODMAN STOPPER

Now has the "Z" handle for easy manipulation. When locked in place it holds. Stopper cannot slip. Gas cannot pass. Adjusted in 30 seconds.

Ask for circulars on this and other distribution equipment.

Nearly a half century of service to the Gas Industry.

GOODMAN — USED SINCE 1897 — Z HANDLE & LOCKING SLEEVE — GAS MAIN STOPPER

The Reliable Shut-Off for Street Mains

Safety Gas Main Stopper Co.
523 Atlantic Avenue, Brooklyn, New York

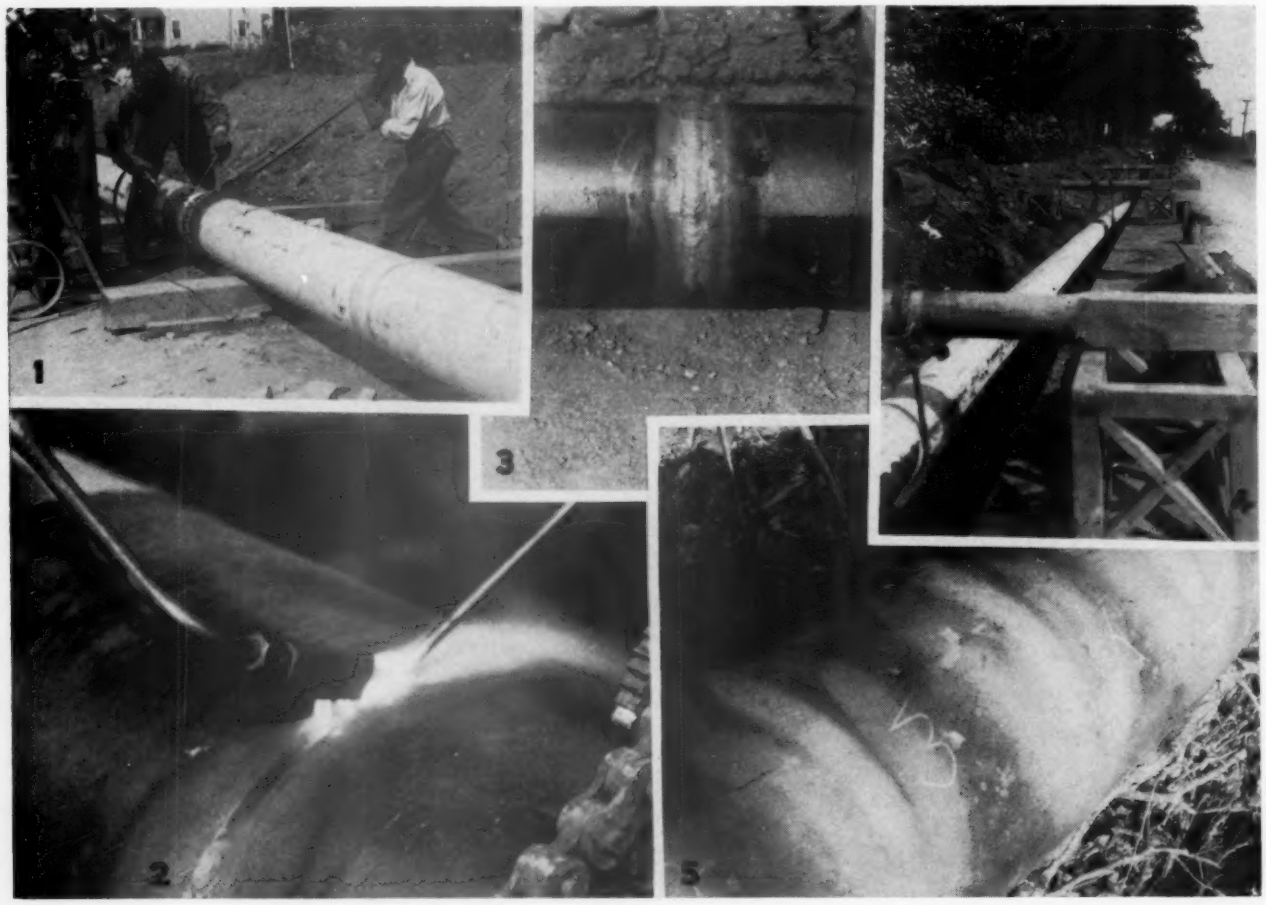
Six Mile All-Welded Gas Line Installed In New Jersey

By
Thomas L. Mellick
Engineer
Central Division Gas Distribution Dept.
Public Service Electric and Gas Company

IN ORDER to provide a gas supply large enough to meet the growing needs of the New Brunswick, Plainfield, and Bound Brook districts of New Jersey, Public Service Electric and Gas Company is now operating high-pressure lines between these communities. One leg of this triangle, between New Brunswick and Bound Brook, is the most recently installed line and represents an interesting pipe-laying project. This line, which is six miles long, connecting with one and one-half miles of a previously existing main, was completely oxy-acetylene welded, with pipe curves effected by wrinkle-bending, an oxy-acetylene heating process. In all, there were 942 joints welded in laying the 29,161 feet of pipe, of which 27,568 feet were of 12-inch pipe, and 1,593 feet were of 8-inch pipe. About 500 feet of pipe were laid per day, and it was estimated that this could have been increased to 800 feet, had it not been for difficulties encountered in the trenching operations.

Trenching Operations

Approximately one-half of the distance was through hard red shale rock. Two digging machines were used to excavate the trench, 2½ feet wide by 4½ feet deep, along the side of the road, while as many as three air compressors were used to break up rock where the trenching machines could not dig. Numerous obstructions in the form of streets, driveways, culverts, and pipe lines were encountered. Portable bridges were used at some of the drives and streets to permit an uninterrupted flow of traffic. A back-filling machine



In these construction views, 1; The welding operator is completing a rolling weld in 12-inch diameter pipe. 2; This close-up shows the 6-flame welding tip in use. Four flames preheat the vee, another flame preheats the welding rod while the sixth flame does the actual welding. The weld is made backhand with the welding flames pointing back toward the completed portion of the weld. 3; This view shows a completed weld, providing a joint that will be leakproof and maintenance-free for the life of the pipe. 4; A welded string was lowered progressively into the trench by means of rope slings. 5; Wrinkle-bends were made by heating a band halfway around the pipe and then bending the pipe to contour. Each wrinkle produces a slight change in direction of the pipe. Pipe wall is not thinned by the process, because compression squeezes the pipe so that metal at the wrinkle is actually thicker than the original wall. Metal on the outside of the bend opposite the wrinkle retains its original thickness.

was used to close up the trench, and three or four trucks were required to haul away excess rock and earth and to bring up pipe and supplies.

As soon as a section of trench was dug, pipe was centered over it on cross timbers which had been laid across the trench at intervals of 20 feet. Mill-wrapped steel pipe in double random lengths, about 40 to 44 feet per length was used. Two or three lengths (occasionally as many as eight on straightaways) were lined-up on the cross timbers by means of special lining-up clamps, and were then tack-welded.

Excess-Acetylene Welding Technique

All pipe joints were welded by the "Lindeweld" method, which employs an oxy-acetylene flame with an excess of acetylene, or carburizing flame, as it is sometimes called. A multi-flame welding tip is usually used with this method, and the welds are made backhand with the welding flame pointing back toward the completed portion of the weld. The speed and economy of this welding method are due to the fact that the surface of the base metal, as it reaches white heat, absorbs carbon from the excess-acetylene flame, thereby lowering the steel's melting point and speeding the welding action. By using a multi-flame tip, further speed is achieved, since this tip provides preheat flames which quickly bring the carburized metal to the sweating condition in advance of the welding flames, and also preheat the welding rod.

The carburizing effect of the excess-acetylene flame has the added advantage of reducing the iron oxide in the weld, which results in a clean, sound weld of good ductility and strength. A low-alloy, high-strength rod especially developed for this welding method is used. This rod develops an average tensile strength of 10,000 to 12,000 pounds per square inch greater than rods previously used for pipe welding, yet has sufficient ductility to meet any requirements.

Welding time was about 8 minutes for a joint in 12-inch diameter pipe with a wall thickness of 3/8 inch. In welding a string together, two welding operators worked simultaneously at different joints, making rolling welds with 6-flame blowpipes. All welds were made at the top of the trench except where obstructions would prevent the lowering of the pipe and the welds had to be made in a hole at the bottom of the trench. The completed string was then welded to the end of the existing completed main. The welds were tested with air pressure and coated with a layer of bituminous enamel, a layer of tar-saturated felt, and another layer of enamel, to protect them from corrosive soil attack.

Lowering the Pipe

Procedure for lowering the pipe was an interesting part of the job. Wood horses were placed in pairs, one on either side of the trench at intervals of from thirty to forty feet. Timbers were laid on these, bridging the welded pipe, and rope was slung from them to support the pipe. The stringers were then removed so that the pipe line hung free over the trench. Ropes were slackened progressively along the line, and the pipe lowered from point to point into the trench. As one section came to rest, the workmen at that point moved to the head of the line and lowering continued until all pipe rested in the trench, except for the unwelded end. This was held at street level, resting on stringers. The lowering process could extend over about 280 feet of 12-inch pipe, due to the stiffness of the pipe.

Wrinkle-Bending

The "wrinkle - bending" procedure of producing a change in pipe direction greatly speeded the project. Due to the curvature of the road, there were a total of fifty-seven bends that could not be compensated for by the natural flexibility of the pipe. Instead of welded fittings, the pipe was "wrinkle-bent," through use of oxy-acetylene heavy-duty heating blowpipes. At the point where the bend was desired, two operators burned off the protective coating with blowpipes, and heated one or more narrow bands at right angles to the axis of the pipe and extending about halfway around the pipe on the side which was to be the inner side of the curve. When a band became red hot, the pipe wall was wrinkled by pulling on the pipe with rope and by using the leverage action of timbers until the desired curvature was obtained. To effect a bend of 5 degrees, which took about 4 minutes, only one wrinkle was made, while sharper bends were made by increasing the number of wrinkles. By using the trench as a guide, calculations as to the angle of bend were unnecessary.

From "Way Down Under"
come the highest grade of selected lambskins.

New Zealand Skins **are noted for their small pores and fine texture. Those we treat conform to definite standards of thickness and absence of holes, scratches or blemishes.**

These we use in the manufacture of

"COLONIAL BRAND"

RECHROME METER LEATHER

a product which has been recognized with universal acceptance by the Gas Industry for over 50 years.

Our leathers stand up in the meter under all variable conditions. They are strong, pliable and unaffected by heat, cold or dampness.

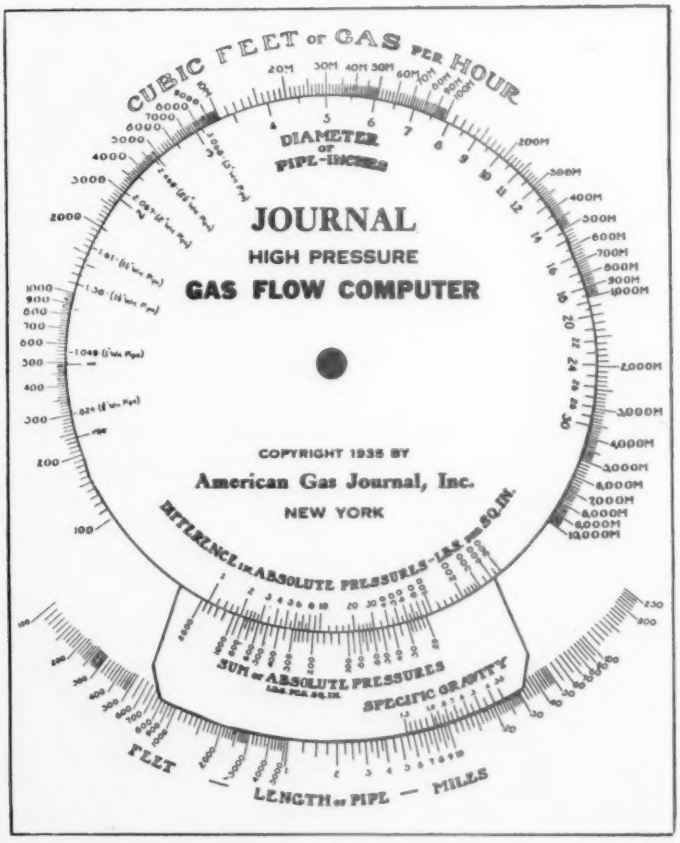
Superior to any substitute offered for this purpose.

We also manufacture Oiled Meter Leather for Iron and Tin Case Meters, Governors and Regulators.

Besse, Osborn & Odell, Inc.
65 SOUTH ST., BOSTON, MASS.

Sales Representatives
Bankart & Samuelson
177 WILLIAM ST., NEW YORK
Wilder & Co.
1038 CROSBY ST., CHICAGO

"Journal" Gas Flow Computers



New Improved Gas Flow Computers now available of durable celluloid, encased in a convenient leatherette cover with complete instructions.

Actual Size 6¼ x 7½

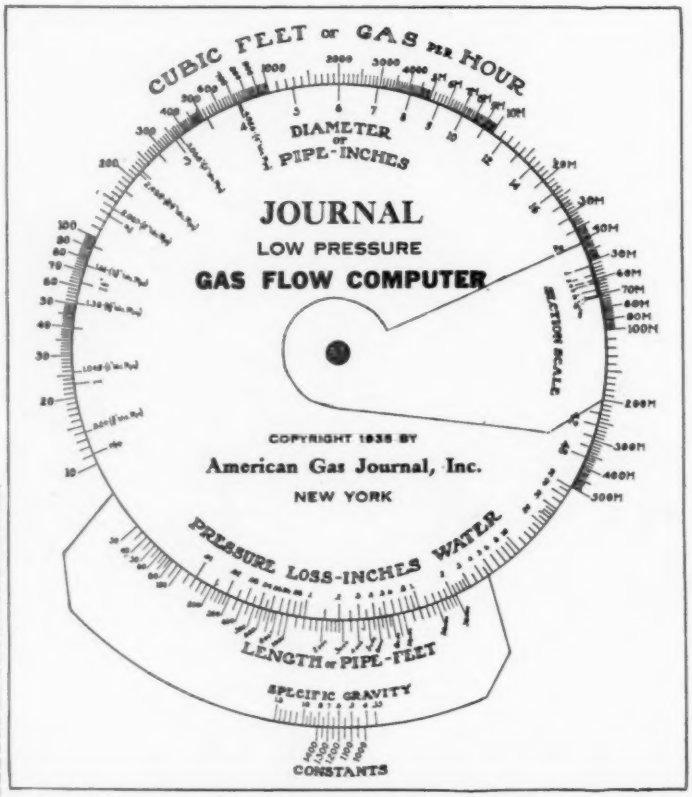
High Pressure Computer Range:

Cu. Ft. of Gas Per Hour—100-10,000 M
Diameter of Pipe Inches ¾-30
Difference in Absolute Pressure—Lbs. per sq. in. 1-500
Sum of Absolute Pressures—Lbs. per sq. in 2000-20
Specific Gravity 1.5-.35
Length of Pipe—Feet 100-5000
Length of Pipe—Miles 1-250

Low Pressure Computer Range:

Cu. Ft. of Gas Per Hour—10 to 500 M
Pipe Diameter ¾" to 48" (including standard and actual weight up to 4")
Pressure Loss Inches .01-10.
Length of Pipe—Feet 30-30,000
Specific Gravity 1.5-.35
Constants 1400-1000

Price $3.50 Each, Postage Prepaid



AMERICAN GAS JOURNAL
53 Park Place, New York

Please enter our order for Computers as follows at $3.50 each, postage prepaid

....HIGH Pressure Computer

....LOW Pressure Computer

NAME .....

ADDRESS .....

News of the Gas Industry

The University of Oklahoma Gas Measurement Short Course

On April 15, 16, and 17 over 650 men enrolled at the 1941 Southwestern Gas Measurement Short Course at the University of Oklahoma. Representatives from companies all over the country assembled at Norman to study the problem pertaining to the measurement and regulation of dry and casinghead gas.

The history of the origin of this nationally known short course is an interesting one and what has been accomplished during these short courses directly attributes to their continued success. In 1923 the first meter school was proposed and held at the University. Only sixty attended this first school. At that time meter men were having trouble in the repair and maintenance of meters so the general subject of the school was along this line. During the second and third years, more time and attention were given to the study and operation of the wet gas meter and proportional meter. The school was beginning to serve as a means of disseminating information for meter men and shop foremen.

At that time each company was measuring and distributing gas their own way. More problems were being encountered in the growing gas industry and thus a greater need for some kind of an educational program was present. In 1927 the name of the school was changed from Oklahoma Meter School to the Southwestern Gas Meter School and a year or so later to its present name. During the sixteen years the meter school has been in existence, 644 operating companies have sent 9,042 representatives to the school, 31 manufacturers have exhibited educational equipment, and 247 instructors have taught 219 topics. This growth reflects the untiring work of the various committee members and the interest shown by the industry in this valuable work.

It is the aim and purpose of the Gas Measurement Short Course to provide, through the cooperation of the University, the various associations and commissions, and gas, gasoline, and oil companies, a means whereby the men in the industry may get together to study problems of the industry. It is hoped thereby to increase the accuracy of measurement and the efficiency of regulation to the end that the public may be better served, the dealings between the consumer and seller put on an increasingly accurate and equitable basis, and that correct information regarding the engineering and practical problems involved be disseminated among the men in the industry.

A school in which both theory and practice is stressed serves as a medium to stimulate interest in the work of the hundreds of gas metermen and technical men that attend. Meter shop foremen are able to gather informative data on meter maintenance as well as to see the latest development in shop equipment that is on the market. There is something for every gas man who attends this short course. The proceedings of the three day sessions are recorded, printed, and bound in book form and sent not only to those who attend the meetings but to men in the gas industry throughout the world.

The Short Course is governed by an Executive Committee, consisting of nine members, each elected for a term of three years, and a General Committee which functions from year to year. The General Committee takes care of all details in connection with the operation of the Course. It also prepares and distributes pamphlets covering practical and usable methods for installing, testing, maintaining, and operating various types of equipment pertinent to the measurement and regulation of gas. The pamphlets are made available to the oil, gas and gasoline industry as reference matter.

To stimulate interest among those attending the Short Course, the General Committee annually awards seven cash prizes. Each contestant is required to write a paper on "What I Learned at the Gas Measurement Short Course." First prize is $15, second $10, and $5 is awarded for each of the next five winning reports. The reports must not be

Above: Notables at the Short Course, left to right—T. J. Strickler, Pres., American Gas Association; R. L. Rountree, United Gas Pipeline Co.; Lee Woodward, Zenith Gas System, Inc.; W. H. Carson, Dean of Engineering, University of Oklahoma.

Below: Some representatives at the entrance of the engineering building as they gathered at the opening of the Short Course. Representatives are from Texas to Minnesota and from New York to California.

more than 500 words in length, and must be confined to the above subject. They are judged primarily on the basis of the interest shown in and knowledge gained from the short course, so that the literary man has no advantage over the practical man.

As in previous years the plan of instruction this year was carried out much in the same manner. All persons in attendance assembled in the engineering auditorium in the morning to hear talks and entered into the discussions on subjects of general nature. In the afternoons periods of 55 minute class room instruction were given on many diversified subjects.

This seventeenth annual short course was the largest in attendance of any in its history, according to R. L. Rountree, chairman of the General Committee. Chairman Rountree presided over the general assembly meeting held in the morning in the engineering auditorium. Approximately twenty classes were held each of the three afternoons, the instructors being engineers and other representatives of oil, gas, machinery, and equipment companies and members of the faculty of the University of Oklahoma. There were representatives from more than half of the states in the union at the school.

At the opening of the meeting on Tuesday morning R. M. Scofield of the Lone Star Gas Company presented a report of the Committee for Study of Practical Methods. The principal address of the morning was delivered by T. J. Strickler, president of the American Gas Association. His subject was "The Gas Industry and the Job Ahead"; other talks were given by E. H. Poe, secretary of the Natural Gas Section of the American Gas Association and Wm. F. Lowe, secretary of the Natural Gasoline Association of America.

On Tuesday afternoon there were twenty-three classes of instruction on many diversified and interesting subjects. Seven or eight classes were going on simultaneously during the three hours of instruction. All of the classes were well attended. Some of the subjects of the afternoon classes included Measurement and Regulation from Extremely High Pressure Gas Wells which was lead by S. H. Smith, Jr. and J. C. Dennis. Other well attended classes were on the subjects of Field Testing and Maintenance of Large Capacity Displacement Meters by J. P. McCarthy of the Oklahoma Natural Gas Company and Gas Accounting—Wet Gas Practices by C. L. Quast of the Sinclair-Prairie Oil Company.

Chairman Rountree opened the Wednesday morning session. At that time the 1940 prize papers were announced by the chairman. In addition two interesting papers were presented by representatives of two meter companies. On Wednesday afternoon classroom instruction was continued. A group discussion on Odorization of Natural Gas was lead by R. M. Scofield of Lone Star. Subjects of the afternoon classes included Problems of Wet Gas Measurement and Regulation by M. S. Fales of Phillips Petroleum Company and C. L. of the Texas Company; and Domestic Meter Shop Practice by F. A. Kihneman of the Arkansas Louisiana Gas Company. On Wednesday evening the annual banquet of the short course was held in the Union ballroom.

The Thursday morning session was again opened by the chairman. Mr. K. R. D. Wolfe presented a talk on the Fundamental Principles of Regulators and Andrew F. Schoeppel of the Kansas Corporation Commission presented a talk on "As a Commissioner Views It." In the afternoon the final classes of the short course were held. A very well attended class was that on Operating and Maintenance Wrinkles for Metermen. This particular class was opened for discussion, lead by L. F. Carter of the Colorado Interstate Gas Company.

This year the equipment exhibits were outstanding and drew a great deal of interest from the representatives. Over fifteen companies were represented at the exhibiting booths in the engineering building. Many new types of developments were shown.

CONVENTION CALENDAR

May

5-8 *A. G. A. Natural Gas Section Convention,* Adolphus and Baker Hotels, Dallas, Texas.

12-14 *Pennsylvania Gas Association,* Skytop, Pa.

19-21 *A. G. A. Production and Chemical Conference,* New York, N. Y.

20-21 *Canadian Gas Association,* Hamilton, Ontario.

22-23 *Natural Gas and Petroleum Association of Canada,* Hamilton, Ontario.

June

3-5 *Annual Convention A. G. A. E. M.,* Ambassador Hotel, Los Angeles, Cal.

9-10 *Northwest Conference Pac. Coast Gas Assn.,* Portland, Ore.

30 to July 2 *Michigan Gas Assn.,* Grand Hotel, Mackinac Island.

September

8-10 *Mid-West Gas School and Conference,* Ames, Iowa.

10-12 *Pacific Coast Gas Assn.* Annual Convention, Del Monte, Calif., Hotel Del Monte.

October

6-10 *National Safety Congress and Exposition,* Chicago, Ill.

20-24 *American Gas Assn. 25th Annual Convention,* Atlantic City, N. J.

Aerial Surveys

The gas, gasoline and oil world, faced with the immediate problem of throwing its resources into the "battle for democracy", has at its disposal new techniques developed within recent months by the aerial surveyors.

Everywhere across the face of the nation "boom towns" are springing up in the vicinity of camps of our armed forces. Even where there are no army camps there is often an industrial upsurge caused by swelling defense orders.

To the engineer and the pipeline company executive this means new transmission lines and the purchasing of rights-of-way as the first step toward servicing our new economy.

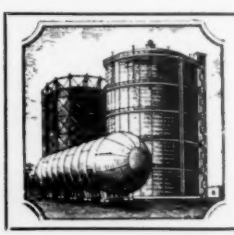
Buying up of rights-of-way, tapping of new fields, slide-ruling available resources, and, finally, distribution itself, will be tremendously speeded up by the aerial surveyor in this emergency which calls for "speed and more speed".

The aerial surveyor's job requires special aerial mapping planes, cameras, analytical precision instruments, and trained personnel.

Three years ago the Abrams Air Craft Corporation was formed as a branch of the Abrams Aerial Survey Corporation to perfect a high-altitude mapping plane that would take the place of then-existent ships converted into mapping craft through the sawing of holes in the floor boards.

The Abrams' "Explorer" was designed as a pusher-type plane with glass-enclosed, hermetically-sealed gondola to insure perfect visibility in all directions. The unique "mapper" was designed to operate at 30,000 feet so as to enable the photographer to take in greater sections per exposure.

Smaller scale maps are sufficient for pipeline survey work on a one inch to 1,000 feet basis. For a close study of distribution lines and projected distribution line sites within a community, one inch to 400 feet is a scale suggested by the aerial surveyors. Power transmission lines for gas companies could be inspected similarly.



STACEY BROTHERS
Gas Construction Co., Inc.
"STACEY-KLONNE" & TELESCOPIC GAS HOLDERS "STACEY BULLET" PRESSURE HOLDERS
PURIFIERS AND STEEL PLATE CONSTRUCTION
Executive Offices: Cincinnati, Ohio
Eastern Office: 21 West St., N. Y. C.

Four of the principal figures in the promotion of the CP Gas Range Program, at the luncheon given in the Hotel Biltmore, New York City, by the Association of Gas Appliance and Equipment Manufacturers. Left to right: John E. Bogan, sales promotion manager, A.G.A.E.M. Domestic Gas Range Division; Geo. L. Scofield, chairman, A.G.A. Domestic Range Division; Lloyd C. Ginn, chairman, A.G.A.E.M. CP Sales Management Committee and sales promotion manager, American Stove Co.; and John W. West, Jr., secretary, A.G.A. Residential Section.

National Home Service Contest Winners Announced

Six of America's foremost authorities and writers on home economics met April 4, with the Home Service Committee of the American Gas Association, to judge the winners in the National Home Service Contest. The contest was open to all home service representatives of gas utilities in the United States and Canada.

The judges were: Eloise Davison, New York Herald Tribune Institute; Katherine Fisher, director, Good Housekeeping Institute and Helen Kendall of the same organization; Virginia Hart, associate editor, House & Garden; Ada Bessie Swann, associate editor, Women's Home Companion; and Earl Lifshey, housewares and major appliance editor, Retailing.

Twenty-nine cash prizes, totaling $500, were awarded for the best demonstrations of CP (Certified Performance) gas ranges submitted in script form. All entries were tested and judged on the following points: A CP gas range slogan title suitable for permanent publicity purposes; originality of script and dramatic effectiveness so as to be adaptable for general use, without change, by all gas companies, dealers, department stores, women's clubs, etc.; and the organization and timing of action of the demonstration so as to simplify advance preparation.

The twenty-nine winners, as just announced by the American Gas Association, include a representative group of home service employees from sixteen states. First prize of $100 went to Jeannette Campbell, Minneapolis Gas Light Co.; Second prize of $75 went to Phyllis Ward, Southern California Gas Co.; Third prize of $50 went to Margaret Phillips, Florida Power & Light Co., and Helen Gram, The East Ohio Gas Co., received fourth prize.

The twenty-five other winners (arranged in alphabetical order) in the national contest include: Home Service Department, Citizens Gas & Coke Utility; Kathleen Atkinson, Providence Gas Company; Naneen Barr, Southern California Gas Company; Elizabeth Baum, Public Service Company of Northern Ill.; Loretta Brady, Public Service Electric & Gas Company; Dorothy Church, The Brooklyn Union Gas Company; Ruth Dickey, Boston Consolidated Gas Company; Caroline Ewing, Oklahoma Natural Gas Company; Grace Frusher, Oklahoma Natural Gas Company; Doris Heidrick, The Gas Service Company; May Louise Hurster, The Laclede Gas Light Company; Helen Kirtland, Republic Light, Heat & Power Company, Inc.; Helen Lillibridge, The Gas Service Company; Irene Muntz, Rochester Gas & Electric Corporation; Ann O'Keefe, Public Service Electric & Gas Company; Beth Porter, Southern California Gas Company; Helen Reilly, Public Service Electric & Gas Company; Betty Schillo, Republic Light, Heat & Power Company, Inc.; Marguerite Scroggie, Southern Counties Gas Company; Lucy Slagle, Atlanta Gas Light Company; Elsa Steinberger, The Brooklyn Union Gas Company; Eliza Stephenson, Jersey Central Power & Light Co.; Frances Stevens, Michigan Consolidated Gas Company; Hulda Ungericht, Ohio Fuel Gas Company; Gladys Vaudreuil, Roanoke Gas Company.

Boezinger Becomes V.P. of Merco Nordstrom

Mr. H. Boezinger, for the past number of years District Manager in Los Angeles of the Pittsburgh Equitable Meter Company of Pittsburgh, Pa., and the Merco Nordstrom Valve Company of Oakland, Calif., has been elected a Vice President of Merco Nordstrom Valve Company. Mr. Boezinger is a graduate of Stanford University. Prior to his affiliation with Merco Nordstrom Valve Company, Mr. Boezinger was engaged in petroleum engineering in both the San Joaquin Valley and Southern California. He has been associated with the Merco Nordstrom Valve Company since its early development and expansion in the oil industry. Mr. Boezinger's additional activities will cover the west coast.

Fairchild and Cheeseman Return from So. American Trip

F. L. Fairchild, President of the Sprague Meter Company and H. Ward Cheeseman, East Coast Representative, recently returned from an extensive tour of South America where they contacted their customers and made a survey of the general situation from a business standpoint. The trip covered some 19,000 miles and included seven countries, namely, Brazil, Venezuela, Colombia, Ecuador, Peru, Argentina, and Chile. They also included in their itinerary such places as Cuba, Jamaica, Panama, and Trinidad, and the entire route was covered by way of Pan American Airways.

Mr. Fairchild states that "some idea of the continent can be had when it is realized that Brazil alone is larger than the U.S. by another Texas and only a visit to these countries could explain the rapid increasing importance of the twenty-one American Republics, and especially when

we realize that over one-half billion dollars has been invested by American capital and placed at the disposal of export and import banks to promote commerce and good will between these countries. With the European war on, South America has been cut off from supplies and is looking to us for its urgent needs. There are, of course, barriers to overcome such as tariff, exchange control and difference in currencies but these things will be ironed out eventually. The most striking and astonishing feature about these countries is the feverish progress they have made in the last half century and no longer do they lead a leisurely sheltered existence ignored by the rest of the world, but tremendous changes are taking place and this seems to be the opportune time for the U.S. to show their friendliness and to strengthen their economic position between the Americas."

Southern California Gas Co. Announces Promotions

Guy W. Wadsworth, Jr., was elected vice president in charge of employee relations of the Southern California Gas Company at a meeting of directors, following the annual stockholders' meeting in April. Mr. Wadsworth and E. N. Simmons, controller of the company, were elected to the board of directors at the annual meeting, filling two vacancies on the board. This announcement was made by F. S. Wade, president. Other officers and directors were re-elected.

Mr. Wadsworth, personnel manager of this company and the Southern Counties Gas Company, has been identified with the gas industry in southern California since 1921, when he was employed by Southern Counties Gas Company in the orifice meter department. He was secretary to the vice president and general manager for about five years, and in 1927 left the company's employ to become assistant financial adviser to the Republic of Haiti under the auspices of the American State Department. He returned to Los Angeles in 1930 to take up personnel work with the Southern Counties Gas Company, and in the fall of 1936 took over the personnel work of the former Los Angeles Gas and Electric Corporation. In the spring of 1937 he became personnel manager of the Southern California Gas Company.

Mr. Simmons, controller of the Southern California Gas Company since 1937, entered the employ of the former Los Angeles Gas and Electric Corporation in 1909 in the auditing department. He became assistant auditor in 1922 and general auditor in 1925.

Mr. Simmons has been active in accounting sections of the American Gas Association and Pacific Coast Gas Association, and is a member of the management committee of the accounting section of the A.G.A., and past chairman of the accounting section of the P.C.G.A. He is a member of the Controllers Institute of America, and several local civic organizations.

Home Service in National Defense

A timely bulletin by the Home Service Committee of the A. G. A. outlines the picture of "Home Service in National Defense." You will be interested to read every word and apply your activities to this national program. Jane Roberts of the Roberts & Mander Stove Company, as Chairman of the Subcommittee has done a fine job in a survey as to just what is being done by home service departments at the present time; what the national picture is; and where the subject matter can be secured.

Copies of this Interim Bulletin No. 62 are being sent to all home service departments and to all members of the Residential Section of the A. G. A.. Additional copies are available at 10c each.

Coal Carbonization Results

The properties and amounts of coke and by-products obtained from carbonization of coal can now be predetermined, Dr. H. H. Lowry, director of the Coal Research Laboratory of Carnegie Tech, announced recently.

Dr. Lowry's method establishes for the first time a formula whereby an analysis of coal, correlated with the temperature at which it is to be coked, accurately forecasts the resulting qualities and amounts of coke and its by-products of tar, gas, and ammonium sulphate.

Dr. Lowry's research is considered most important as offering industry increased economy and scientific control over the results of the coking process.

"Evansville Meets the Challenge"

George L. Roach, assistant to the president of Servel, Inc. has been appointed general sales manager of the "Evansville Meets the Challenge" program sponsored by the Evansville, Ind. Chamber of Commerce, it has been announced by F. B. Culley, general chairman of the movement.

Mr. Roach will aid in recruiting and will direct the 150 or more individuals from the classified business and professional groups who will effect direct contact in the promotion of a greater civic spirit and an expanded Chamber of Commerce program of activities.

Vandergriff Succeeds Hudson

R. J. Vandergriff has been appointed manager of the House Heating and Appliance Sales Division of Laclede Gas Light Co., St. Louis, Mo. He succeeds W. A. Hudson, who resigned as of April 1st.

REED'S 4 WHEEL Razor Blade Pipe Cutters

IDEAL FOR ANY TRENCH OR OTHER CLOSE QUARTER JOBS

$4.67 F. O. B. ERIE

Capacity
½" to 2"
Weight 5 lbs.

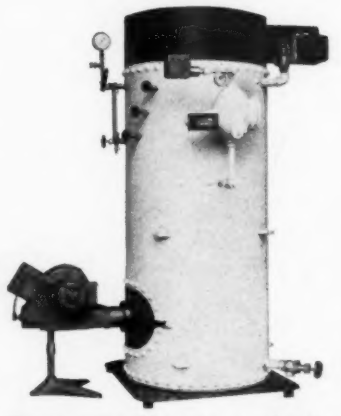
The REED FOUR WHEEL Cutter operates with a short back and forth motion through only one-third of a circle. Each of the four wheels exerts the same pressure on the pipe, and all 4 therefore cut evenly and completely through the pipe at the same time.

Equipped with Reed special alloy RAZOR BLADE Wheels, which cut with remarkable ease, leave little burr, and have a long life of useful service.

A sample cutter for test and trial may be ordered on memorandum invoice, to be paid for if retained or returned for credit if unsatisfactory. Try it once, and you will use no other.

REED MFG. COMPANY
1436 W. 8th Street • ERIE, PA.

LATTNER
GAS — OIL BOILER
3 HP to 35 HP.



Burns natural gas or regular furnace oils with equal efficiency.

P. M. Lattner Mfg. Company
Cedar Rapids, Iowa

INDEX TO ADVERTISERS

American Meter Co. 8
Autogas Corporation 32
Barber Gas Burner Co., The 56
Besse, Osborn & Odell 59
Blaw-Knox Company 36
Carbide & Carbon Chemicals Corp. 55
Cast Iron Pipe Research Assn., The ..... —
Chaplin-Fulton Mfg. Co., The 51
Clark Bros. Co. 4-5
Cleveland Gas Meter Co. ..... —
Cleveland Trencher Co. 46
Coal Carbonizing Co. 67
Columbia Gas & Electric Co. 29
Connelly Iron Sponge & Governor Co. 56
Cribben & Sexton Co. 30
Cruse-Kemper Co. 40
Dresser Mfg. Co. 6
Gas Machinery Co. 40
Gas Purifying Materials Co. 52
General Coal Co. ..... —
Harper-Wyman Co. 41-42
Heath Tree Service, Inc. ..... —
Henry Furnace & Foundry Co. 45
Lambert Meter Co., Inc. 51
Lattner Mfg. Co., P. M. 64
Lavino & Co., E. J. 51
Lennox Furnace Co. 32
Merco-Norstrom Valve Co. 23-24
Metric Metal Works 8
Monmouth Products Co. 45
Paramount Products Co. 56
Partlow Corp., The ..... —
Phillips, Alfred I. ..... —
Pittsburgh Coal Co. ..... —
Pittsburgh Equitable Meter Co. 2
Reed Manufacturing Co. 64
Remington Rand Co. ..... —
Republic Heaters Sales Co. 32
Reynolds Gas Regulator Co. ..... Front Cover
Roberts-Gordon Appliance Corp. ..... —
Robertshaw Thermostat Co. ..... —
Roper Corp., Geo. D. ..... —
Ruud Manufacturing Co. ..... —
Safety Gas Main Stopper Co. 57
Semet-Solvay Engineering Corp. 3
Servel Electrolux Div. ..... —
Skinner Co., M. B. ..... —
Sprague Meter Co., The ..... Fourth Cover
Stacey Bros. Gas Construction Co. 63
Superior Meter Company 39
Titan Valve & Mfg. Co., The ..... —
Union Carbide & Carbon Corp. 55
United Engineers & Constructors, Inc. 56
West Gas Improvement Co. ..... —
Worthington Pump and Machinery Corp. 26

Position Open

Wanted—A good appliance salesman to sell gas ranges, storage water heaters and gas refrigerators. Apply by letter to Mr. S. R. DeFrese, The North Carolina Gas Corp., Reidsville, N. C., giving age, experience, references and other details.

Position Wanted

Wanted—Position offering chance of advancement. I am 36 years old and have had 17 years experience with my present employer. Understand service of all appliances and house-heating on both Natural and Artificial gas. At present I am superintendent in the distribution department. Replies confidential. Write Box 119, c/o American Gas Journal, 53 Park Place, New York City.

For Sale

Water Gas Equipment for Sale—Due to a proposed conversion of system from water gas to butane gas, we will have available for sale complete five foot water gas works equipment in good condition. List of equipment will be sent on request. The North Carolina Gas Corp., Reidsville, N. C.

A Book for Gas Appliance Salesmen

Domestic Gas Appliances by A. M. Apmann. Gives practical working knowledge of the technology of appliances and characteristics of fuels. Ranges, Water Heaters, House Heating and Refrigeration are fully discussed. 238 pages, many illustrations, stiff cover. Special close-out price, 50c. American Gas Journal, 53 Park Place, New York.

Industrial. The 1941 edition of the Johns-Manville Industrial Products Catalog gives information and recommendations on high and low temperature insulations for every industrial need from 400 deg. F. below zero to 2500 deg. F. above. Data are also included on refractory products and castables; specifications on J-M bonded asbestos built-up roofs and insulated roofs; on corrugated Transite for roofing and siding; on industrial friction materials and other products.

Copies available on request to Johns-Manville, 22 East 40th Street, New York City.

Water Conditioning. A new 48-page catalog on Hot Process Water Softeners for removal of hardness, silica, and other scale-forming material from boiler feed and industrial process waters, has been published by Cochrane Corporation, Philadelphia.

The book contains a nine-page appendix of feed-water chemistry, in addition to heat balances, flow diagrams, two-color construction drawings, and engineering tables and charts. Effective treatments for all water conditions are discussed. Various types of installations are diagrammed and considerable space is devoted to illustrations and descriptions of accessory equipments and their various functions.

Gas Fired Boilers. The 64-page 1941 catalog issued by National Radiator Company, Johnstown, Pa., illustrates and gives data on boilers and units for all fuels including gas.

Ratings and data on radiators, convectors, enclosures, hot water heaters and technical information is given.

A double index is an aid in locating the particular boiler or other equipment desired for any job.

Welding and Cutting. Bulletin of Alexander Milburn Co., Baltimore, Md. describes their regulators and their cutting and welding equipment for oxy-acetylene welding as well as their paint spray equipment and carbide lights.

Drying Equipment. Featured in an attractive new 8-page bulletin in the new Turbulaire Dispersion Drver manufactured by Western Precipitation Corporation of Los Angeles. Copies of this bulletin may be obtained by writing the company at 1016 West Ninth Street, Los Angeles.

It is claimed that the turbulent dispersion in high temperature gases made possible in this equipment gives the activated aeration necessary to speed the drying cycle.

Their field includes slimes, pulps and other colloids that cannot be filtered. In addition, press cake, dewatered cake from centrifugals, insecticides, industrial wastes and many technical chemicals all come within the reach of its adaptability. It is claimed that installation costs are low. Capacities are from 75 pounds to 4,000 pounds water evaporation per hour.

Validity of City and State Gas Regulations

(Continued from page 44)

tants of a city shall pay heavy penalties for wilful refusal to make and file certain reports with the city authorities.

During the trial testimony was given which proved that the company officials did not believe its company was required to file the reports because in the year when the law was enacted, the company was not doing the kind of business which required filing the reports, although later a change of the company's business may have brought it within provisions of the law. In holding the company not liable, the court said:

"Upon the whole, it seems to us that the reports which were required to be made by a corporation to which the statute was then applicable cannot be made by a corporation like the Utilities Company. . . . We think the conclusion a reasonable one that . . . the proper construction of the law should be that it applies only to persons, companies and corporations of the same character as were in existence at the date of the passage of the Act. . . . The Utilities Company was in no event subject to the penalties unless it 'wilfully failed or refused to make such reports.' The word 'wilful' is in different connections used in different sense. Here, it is used in a penal statute—a statute imposing a penalty. So used, it has an 'accepted, a restricted or well defined meaning.' It is universally held that the word 'wilful,' when used in a penal statute, means with evil intent, or without reasonable ground to believe the act lawful."

Inventory Control Methods

Adequate control of materials is one important aspect of the demands of increasing industrial production. To meet production schedules, manufacturing companies must be sure to have the necessary materials and supplies at all times. Shortages can cause costly delays in operations but excessive investment in inventories may be equally objectionable. Under present industrial activity many companies may find it necessary to reexamine and reappraise their inventory control practices.

A report "Inventory Control Methods" recently issued by the Policyholders Service Bureau of the Metropolitan Life Insurance Company offers helpful suggestions in this connection.

The report is based on data contributed by a number of industrial companies that are believed to have developed sound practices of controlling inventories of supplies, direct materials, and finished goods. It is not intended to cover the control of work-in-process inventories, nor does it apply to the merchandise control policies of retailers and wholesalers.

The report summarizes specific advantages of a formal system of inventory control, from the financial and operating points of view, and outlines six basic elements which are normally part of a formal system.

A copy of this report is available to executives who address the Bureau on their business stationery. Address Policyholders Service Bureau, Metropolitan Life Insurance Company, 1 Madison Avenue, New York, N. Y.

Armstrong Joins Worthington

Addison C. Armstrong has joined the Worthington organization at its Holyoke, Massachusetts, Works, as Manager of the Ordnance Division. He is directly in charge of the production of ordnance equipment at that plant.

Mr. Armstrong was formerly affiliated with the Truscon Steel Company as a departmental manager. Previous to that he was associated with the Bartlett-Hayward Company and the Campbell Metal Window Corporation, both of Baltimore, Maryland.

McCall's Magazine Award

The bronze plaque design which will be first prize in the "McCall's Magazine" Awards for gas utility home-service departments has been decided upon. The Awards, which will be administered by the American Gas Association, will be presented for the first time at the A. G. A. Annual Convention in Atlantic City, N. J., in October, 1941. Entries for the Awards must be in the hands of the Association by August 1st.

Large and small gas utility home service departments will be able to compete on an equal footing for the McCall's Magazine Awards. Entrants are to submit papers of 2,000 words or less covering the work of their home service departments under five heads: (1) the aim of the department, (2) the training of personnel and sales people, (3) community activities engaged in by the department, (4) any increase in scope of activities in the current year over the preceding year, and (5) accomplishment of aim.

The gas utility home service director or directing head of the home service department of the company in the United States or Canada, which has made, in the judgment of the Jury of Awards, the most outstanding contribution to the advancement of better living in the home through the promotion of domestic gas appliances and equipment will receive the "McCall's Magazine" Award plaque as first prize, together with a check for $100.

Second prize will be a framed illuminated parchment and a check for $50, while the third prize each year will be a framed illuminated parchment and a check for $25.

Catalogs

Blowers and Exhausters. Roots-Connersville Blower Corp., Connersville, Ind., has issued an eight-page, two-color folder, Bulletin G-70, which covers briefly the applications of its complete line of products.

The folder is profusely illustrated with installation views, and space is devoted to positive displacement blowers, positive gas exhausters and boosters, rotary displacement meters, liquid and vacuum pumps, centrifugal blowers and exhausters, and inert gas generators.

Synthetic Rubber. A 20 page compounding manual for Hycar O. R. an oil resistant type of synthetic rubber has been published by the Hydrocarbon Chemical and Rubber Company, Akron, Ohio. The company was jointly formed last year for the manufacture and sale of synthetic rubbers by The B. F. Goodrich Company and the Phillips Petroleum Company.

Worthington Bulletins recently issued cover single horizontal two and three-stage compressors, saddle-mounted centrifugal pumps for handling hot and volatile liquids, single-stage condensate pumps, single-stage and two-stage steam-jet ejectors and refrigeration compressors.

Protective Coatings. General catalog of Wailes Dove-Hermiston Company, Westfield, N. J. includes many finely illustrated pages on the application of their protective coatings for pipe line construction. A tabulation of recommendations for cold applied paints and hot coatings is included. Copy on request.

New Wrinkle Finish. The Roxalin Flexible Lacquer Company, Elizabeth, New Jersey, has issued a 4 page bulletin on Rincontrol, their new wrinkle finish. This 8½ x 11 bulletin includes a sample finished panel and illustrates and describes eight exclusive Rincontrol features. Also shown are several outstanding products using this latest in textured enamel finishes.

Liquid Level Gauges. A catalog on Liquid Level Gauges has been published by The Bristol Company, Waterbury, Conn.

Float, Pressure-Bulb, Pressure, Air-Bubbler, Counterpoise and Differential Pressure type water and liquid level gauges are described for all types of applications. Copy on request.

JULIUS BRUDER

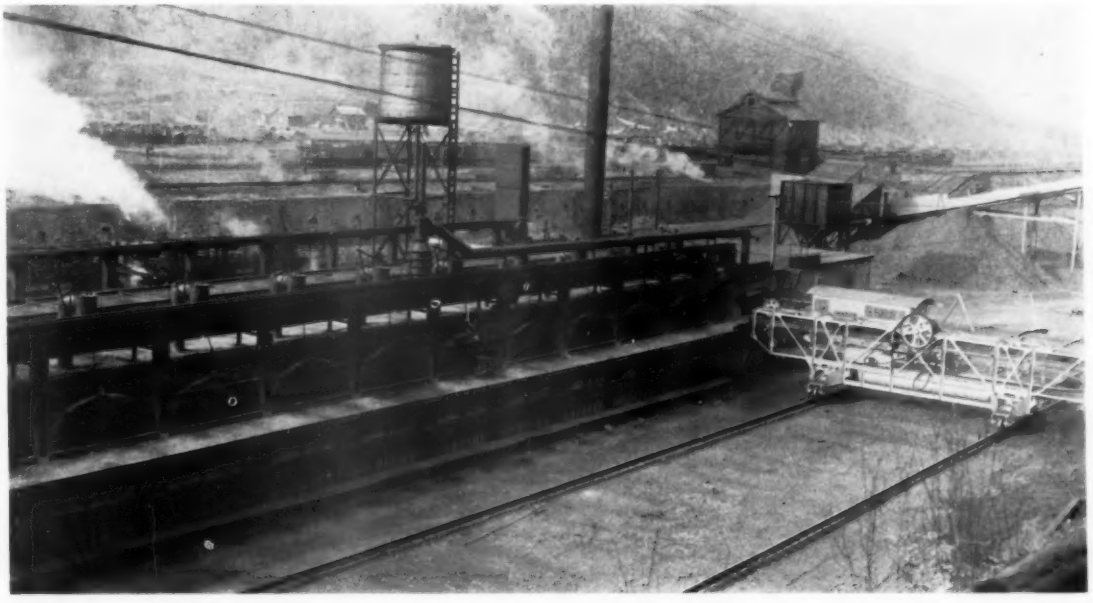
Julius Bruder, Superintendent of D. McDonald & Co. Works of American Meter Company, died in St. Peter's Hospital, Albany, at 10:30 A. M., April 17.

Mr. Bruder was 57 years old. He had been with American Meter Company in Albany since January 26, 1903. He started as a draftsman, and was progressively promoted until he became Superintendent of the factory. He conducted this office with great ability for the past twenty years, and contributed many improvements to gas meter manufacture.

He is survived by two sisters, Mrs. Caroline Walsh and Miss Theresa Bruder, and a brother, Charles Bruder.

WE WELCOME YOUR INQUIRIES REGARDING

CURRAN-KNOWLES GAS AND COKE OVENS AND EQUIPMENT



Curran-Knowles Ovens successfully carbonize Low Volatile, High Volatile, Swelling or Non-Swelling Coals.

Give a high yield of superior quality coke for water gas generator fuel, industrial and domestic use; a high yield of tar of excellent quality and a uniform quality of gas which meets Commission requirements.

Substantial construction. Low initial cost per M capacity. Low operating cost due to simplicity of design. Built to suit any situation. Over 6 years' successful operation.

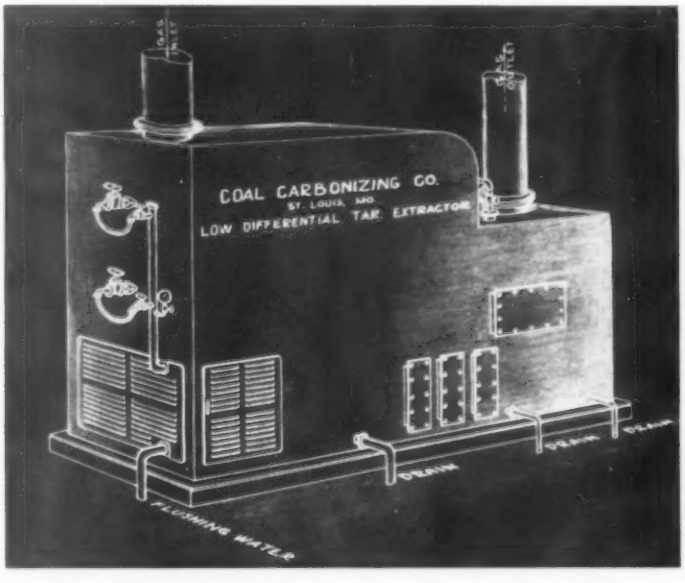
NEWS! A LOW DIFFERENTIAL TAR SCRUBBER

THE C. C. C.'S LOW DIFFERENTIAL TAR SCRUBBERS

are small, and compact units effecting intimate contact between liquid and gas. Employing the Brassert Stationary Disintegrator.

LOW COST HIGH EFFICIENCY

We welcome your inquiries



COAL CARBONIZING COMPANY

CONTRACTORS & ENGINEERS
BANK OF COMMERCE BLDG.
ST. LOUIS, MO.

SPRAGUE

● Forward and on to better equipment — now more than ever, discriminating engineers are recognizing the real value of Sprague's Policy of simplified mechanism and precision construction which insures unequalled accuracy in measurement.

MARCHES FORWARD

SPRAGUE METER No. 4

designed for small industrial installation offers greater capacity in a more compact unit. Rugged in construction, made of cast iron, makes for rigid strength, and simplified mechanism permits a small meter with greatest efficiency. Capacity 600 cu. ft. at ½" W.C.

For complete information write today for catalogue No. 22

THE SPRAGUE METER CO. BRIDGEPORT, CONN

DAVENPORT IOWA • LOS ANGELES CALIF. • HOUSTON TEXAS • SAN FRANCISCO CALIF.